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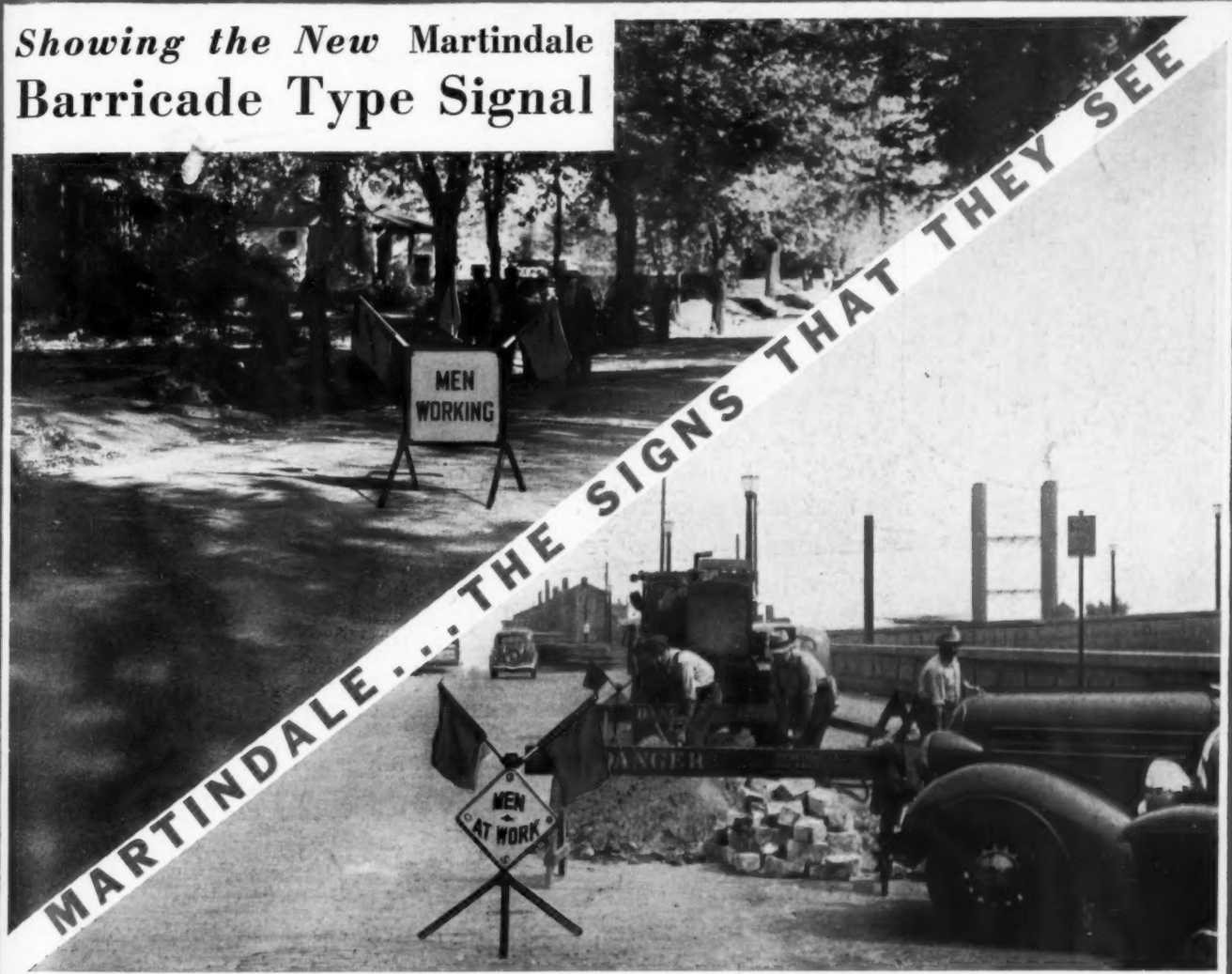

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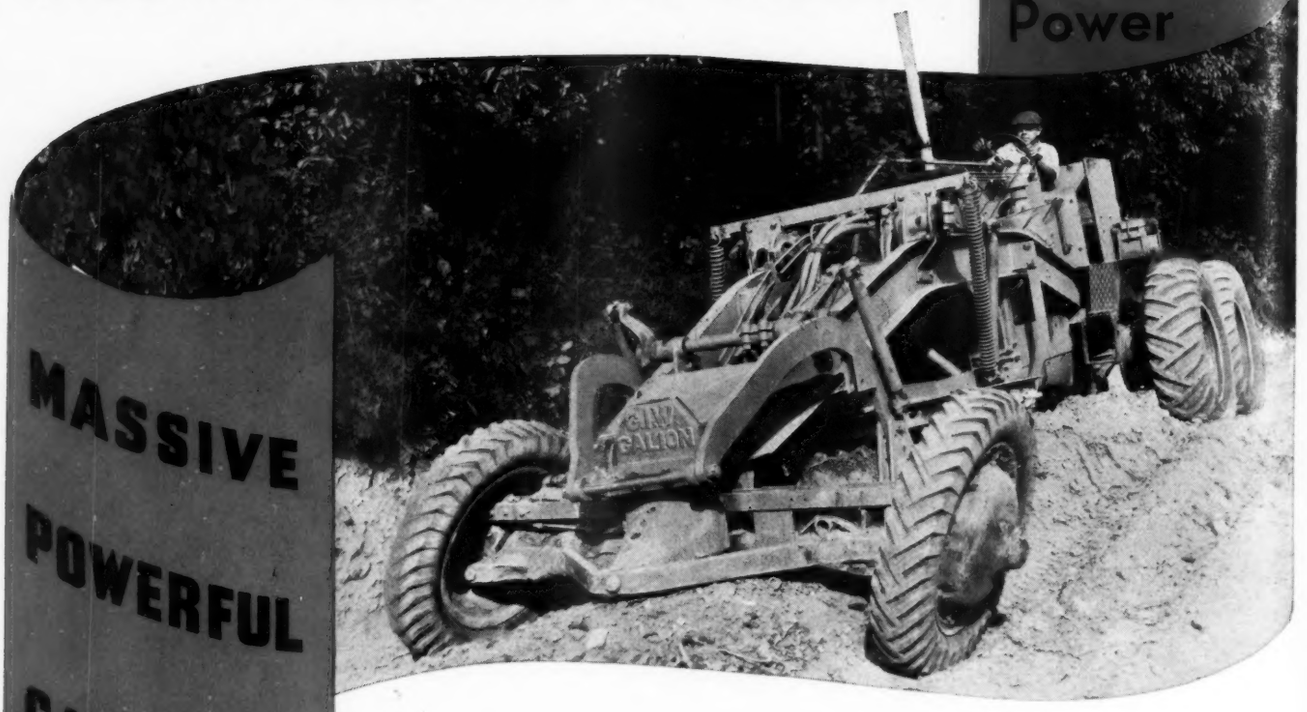

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VOL. 67 PUBLIC WORKS No. 11

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NOVEMBER, 1936

PUBLIC WORKS

Devoted to the interests of the engineers and technical officials of the cities, counties and states

NOVEMBER, 1936

VOL. 67, NO. 11

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TIMEWASTERS

Greetings:

Back in September we asked someone to compute the diameter of the smallest sphere to enclose four balls whose diameters are 3 inches each. There has been no overwhelming rush to answer this problem which was submitted by Mr. Anderson of Kalamazoo, Mich. Well, gentlemen, try making these balls into a tetrahedron first. Yes, the answer is 6.67424 inches.

The pipe problem, also dating back to the September issue, works out very nicely, we believe, if you start out with the assumption that the gentleman laid 1 foot of 16-inch pipe.

Now, coming on the problems in the October issue, the ages of the five young men were 36, 30, 24, 18 and 12. In the cow deal, 31 cows were involved, and the division from there on is obvious.

Then, there is the matter of the bacteria and the bottle (see October issue). Well the ol' bugs did that last half-bottle in 1 minute flat. Figure what happens in a water supply then and you'll know why the old saying: "The only safe water is a chlorinated one."

The Train Accident

A train, an hour after leaving the station, meets with an accident that detains it for an hour; after starting again it proceeds at three-fifths of its former rate and arrives at its destination 3 hours behind schedule. But had the accident occurred 50 miles farther on along the line, it would have arrived 1½ hours sooner. Find the length of the trip.

Sort of Slow Time:

Ikey and Mikey run a mile race. In the first heat Ikey gives Mikey a start of 11 yards and beats him by 57 seconds. In the second heat Ikey gives Mikey a start of 81 seconds and is beaten by 88 yards. In what time could each run a mile?

Both the above are contributed by John Bevan, who is hereby thanked most warmly for these welcome Timewasters. Among the many other letters is one from Walter S. Wheeler of New Hampshire, who again brings up that question (see PUBLIC WORKS, Jan. 1935) of the smallest man mentioned in the Bible. We thought we made that clear, and we've neglected our Bible study since (played our first round of golf last week). We believe Mr. Wheeler now recognizes that a man would have to be pretty small to sleep on even as large a watch as an Ingersoll. W. A. H.

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A. PRESCOTT FOLWELL, Editor **W. A. HARDENBERGH,** Asso. Editor

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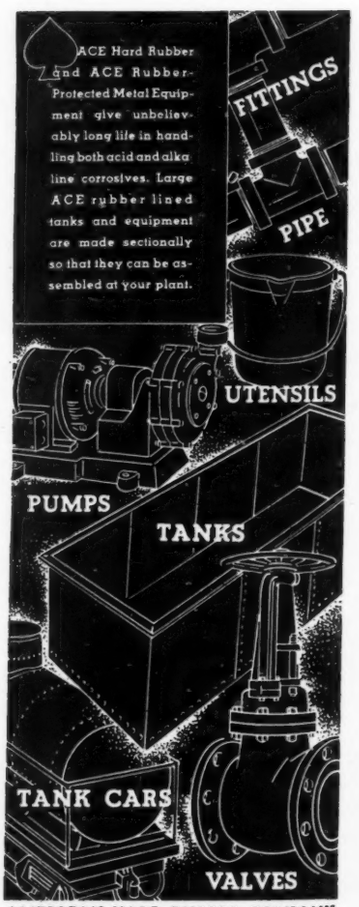
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PUBLIC WORKS

City, County and State Engineering and Construction

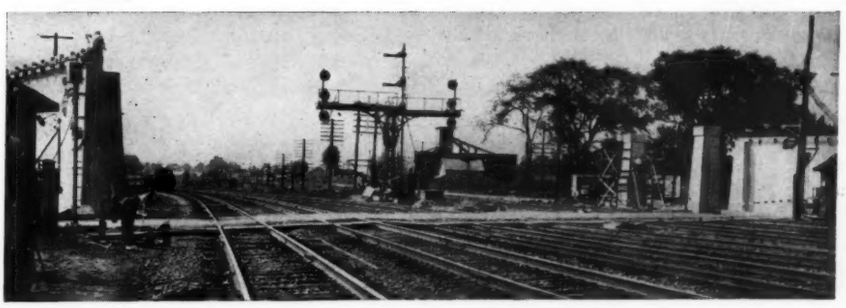
Vol. 67 *November, 1936* No. 11

Death Trap at Carman, N. Y., Eliminated By Construction of Overhead Crossing

By A. W. McNEIL

ONE of the most dangerous railroad crossings in the State is soon to be eliminated at Carman, N. Y., on the outskirts of Schenectady, when an overhead bridge will carry the heavy travel that now passes over the New York Central's main right of way.

The route is one of two between Schenectady and Albany, coming into the capital city by way of the old Western turnpike and Western avenue. Many shocking accidents have occurred at the Carman crossing and years of effort will culminate when the new structure is completed. Work began May 15 and will be finished in November, with 175 days allotted to the project.



Grade crossing now being eliminated

The total cost of construction will be $187,000, of which fifty per cent will be borne by the railroad, forty-nine per cent by the State, and one per cent by the county. To this must be added the figures for property damage, as a score of homes along the Carman road and Hamburg street are affected. Most of the property owners have willingly accepted the price offered.

The approach is to consist of a roadway thirty feet wide with a concrete sidewalk five feet wide on each side. The walk is to be of cantilever construction, supported on its inner edge by piers. The approach on each side of the tracks is to be supported by twelve concrete piers, which extend about five feet below ground, the base being approximately thirty feet by four feet, tapering toward the top, the heights of the piers increasing from four feet to a maximum of nineteen feet over the tracks.

The soil is a loose sand and the piers are supported by more than 550 concrete case pedestal piles, each from 50 to 60 feet long. A steel shell and contained core was machine-driven to a depth of forty feet, and the 14-inch core was then removed and concrete forced into the shell under pressure. An iron casing dropped into the shell was filled with concrete up to the level with the ground and the outer shell was then removed, leaving the concrete-filled case as a solid support of the pier. The pile driving operations were sub-let by Foley Construction Company, which received the general contract, to the Western Concrete and Pile Corporation of Chicago, which has also the contract for the pile driving work for Schenectady's new armory, now under construction.

The bridge across the tracks will be of steel in two spans supported by concrete pillars nineteen feet high. There will be two pillars in the center of the tracks and the span to each side will be about seventy feet. The steel bridgework is supplied by Phoenix Bridge Company of Phoenixville, Pa. A Pawling & Harnischfeger derrick is used. Steel work on the section across the tracks began about August first.

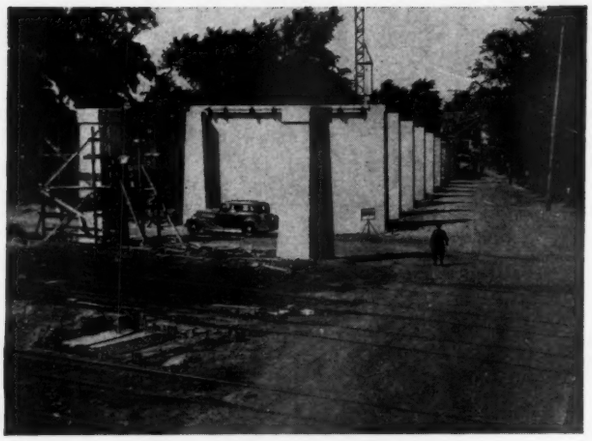
The crossing from end to end will be about 1,500 feet long. The approaches will have a grade of five per cent.

A Smith mixer is in use to mix, lift and pour concrete into wooden forms. All the concrete forms are made of 5-ply wood veneer in strips 28 inches wide and eight feet long, backed by 2 x 6 timbers. This type of form gives a concrete surface comparatively free from board marks.

Construction of the bridge calls for over 25,000 cubic yards of concrete of all classes. The retaining walls are Class B mix, with cement 493 lb., sand 1,280 lb. and stone 2,000 lb. per cubic yard. The piers are Class C mix, with 432 lb. cement, 1,330 lb. sand, and 2,118 lb. stone per cubic yard. The roadway is to be of broomed concrete. The steel tonnage will approximate 606,100 lb.

There is an average of seventy-five men employed on the work.

The principal reason for the delay in beginning the project after so many years of agitation has been a



Concrete piers for supporting approach

disagreement between the authorities involved as to whether there should be an overhead structure or an underpass. The county board of supervisors and the city planning commission claimed that the former would seriously affect real estate values. State highway officials and the railroad contended that drainage problems made an underpass costly and impracticable.

Simple Test of Water Content of Sand

A simple way of determining the amount of "free" water and "absorbed" water in sand, as for concrete mixing, has been developed by the Bureau of Public Roads, one which the engineers consider much simpler and more accurate than those now in use, and adapted to both laboratory and field control of concrete mixtures. The method was developed by D. O. Woolf, associate materials engineer in the Bureau.

Moist sand containing free water can be shaped into molds by light pressure. Dry sand cannot be molded. After experimenting with cones of many shapes, Mr. Woolf found that sand—lightly tamped into an inverted cone with a top diameter of 1½ inches and a bottom diameter of 3½ inches—contains free moisture if it holds its shape when the cone is removed. At the point where the sand slumps upon removal of the cone, free moisture is gone.

Many methods for determining when sand is surface dry have been suggested, but extensive study by the Bureau has shown that most of these methods are either likely to be inaccurate or so delicate that their use in routine testing is not warranted. The cone test has been adopted by the American Association of State Highway Officials.

Concrete Pavement in Swamps

WHEN a subgrade won't even support the weight of pavement under traffic, the beam strength of concrete can still be utilized to advantage. This has been proved by the North Carolina State Highway Department.

In the low, flat, tidewater section of eastern North Carolina the soil near streams and bays is sometimes so marshy that roads built upon it sink from sight. After thorough study, the least expensive type of construction at such location has been found to be a reinforced concrete slab resting on piling. Such a surface serves both as bridge and pavement.

The first installation of this type is on State Route 342 between Hertford and Elizabeth City. The original pavement was built on a log mat, covered with gravel, but the weight and shaking of the traffic using this popular highway gradually settled it into the underlying muck.

As the slab continued to sink it was covered with maintenance material until a fill of 3 to 4 feet had been placed over the concrete and it became obvious that a substantial foundation must be provided to save the next surface from a similar fate.

Short piling were then tried for support of the slab, but they also failed.

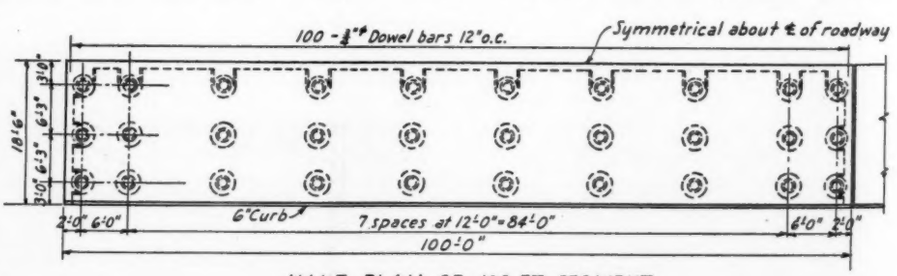
Borings were then made to determine the nature of the foundation which showed a soil profile of: peat, 24 ft.; quicksand, 13 ft.; soft marl, 3 ft.; quicksand, 10 ft.; and soft blue marl, 11 ft.

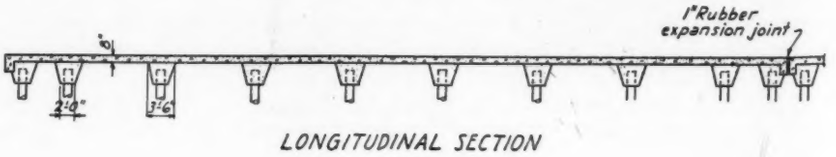
To meet this condition long piling driven to firm bearing was needed. The design adopted is shown in the accompanying plan and profile.

The unusual features of this design are the beam, monolithic with the pavement, that extends along the center joint and transverse joints, and the conical cap for the piling. Outside edge has integral curb.

After the piles have been driven, the subgrade is brought to the proper level. Cone-shaped holes are made around the piling with a metal form as shown. Reinforcement is put in position. The piling cap is then placed monolithic with the slab. Concrete for a whole panel is placed in a continuous operation and is mixed, spread and finished as for an ordinary concrete pavement..

The first installation at Hertford Causeway was so successful that a second section, just completed, was designed for a bridge approach in Elizabeth City. The total cost of the 1,128 ft. of supported 8-in. 18-ft. slab on the first job was $17,630, or $7.81 per sq. yd. of pavement. The project was completed in 67 working days.—*Concrete Highways and Public Improvements.*





Coating for Steel Water Mains in Los Angeles

THE Los Angeles Bureau of Water Works and Supply has laid many miles of steel pipe from 16 inch to 8 ft. diameter or larger and pays special attention to the matter of coating the pipe. Prior to 1930 both asphalt and tar were used, but in the latter year an intensive study of coal tar enamels was begun with a view to developing standard materials of this class and methods of applying them. The following information covering the results arrived at to date are abstracted from papers prepared for the American Water Works Association by Harry Hayes, assistant engineer of the bureau, and Lawrence E. Goit, its chief draftsman.

In the last three years, developments in the coal tar coating industry have produced enamels in which the objectionable features which formerly limited its use have been eliminated. This has been done through the use of a new type of so-called "Plasticised" coal tar pitch. Enamels made from this will withstand temperatures of 160° F. continuously for 24 hours or more without sagging, and as low as 20 to 30° below zero without cracking, and have a ductility approaching that of asphalt coatings; and will retain these characteristics when soft enough for centrifugal application or hard and tough enough for an exterior coating; and have all the excellent corrosion-resistant properties of the old-type coal tar coating.

Until recently, all primers available became so soft at any temperature above 100° that the enamel would pull off by its own weight. But within the past year a primer has appeared on the market which gives a strong bond at temperatures up to 150°.

The Los Angeles water bureau now coats both surfaces of all underground steel pipe and the inside of all exposed pipe with this new type of coal tar enamel, purchasing by bid under rigid specifications, the compliance with which is insured by severe tests. These tests are of two kinds—the customary physical tests for softening point, penetration, ash and specific gravity; and performance tests. The tests under the first heading are the A. S. T. M. standards. For softening point, ring and ball method, D-36-26. Penetration at 77° F. and 115° F., D-5-25. Ash, D-271-33. Specific gravity, D-71-27.

The performance tests are: High temperature sag test. Low temperature cracking test. Cold bend test (a) on initial heating of enamel, and (b) after 1½ hours continuous heating. Soil stress test. Stripping test. All the tests are made on plates of mild steel which are sandblasted just prior to use.

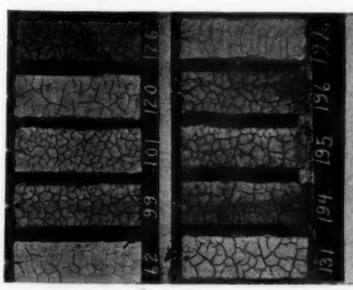
In the high temperature test the melted enamel is daubed on about 1/16 inch thick. When hard, each specimen is marked with three equally spaced lines scribed on the enamel and the lines filled with chalk dust and the specimen is then hung vertically in a room where the temperature is held at 160° F. for 24 hours. Any sag occurring in the enamel can easily be detected by the movement of the lines.

In the low temperature test the specimens, prepared as above, are placed directly in a refrigerator where the temperature is held at—10° F. After eight hours they are removed and examined for evidence of cracking, both visionally and with an electric flaw detector; usually, however, an enamel that cracks loosens and falls off the plate.

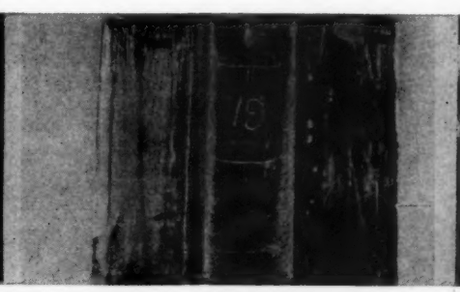
For the cold bend test, an Olsen Universal testing machine is placed in a room of 40° temperature, where the specimens have been kept for at least four hours prior to testing. They are then placed on supports 9½ inches apart with a center point loading. The rate of bending is regulated to produce a uniform rate of deflection of one inch per minute at the center of the span. During the bending, the high-tension brush of an electrical flaw detector is held in contact with the enamel at the center of the plate. The instant a crack occurs in the enamel the high-tension spark jumps through the break and the deflection for initial cracking is measured. The bending is continued until a total deflection of 1½ inches is attained, and then, if there is a crack in the enamel, the ends are turned back to where it adheres tightly to the steel and the exposed area measured.

In the soil stress test, soils are used representing the most severe conditions along the proposed pipe route; these are mixed with water until thoroughly saturated and then troweled onto the enamel specimen to a depth of about ⅜ inch. Specimens so prepared are hung in a ventilated room kept at 70° F. until the mud has become thoroughly dry. The mud is then soaked with water until soft and washed from the enamel, the plate is dried and examined for rupture or other effect of soil stress. Recently the bureau has developed a whitewash which materially aids in the resistance of soil stress, this being a mixture of quicklime, water, salt and an oil plastisizer which is applied to the pipe after the completion of the outside coating, and not only prevents absorbing heat from the sunlight but also prevents the severest soil from bonding to and rupturing the coating.

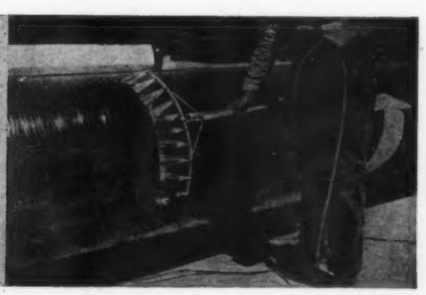
In preparing a specimen for the stripping test, one



Appearance of typical soils after drying.

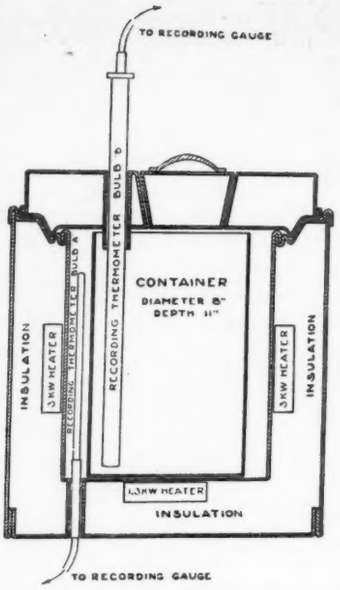


Typical test specimens of old type enamel. Note sag of lines on specimen 19.



Inspecting outside of pipe for "holidays," using electricity.

end of it is heated until the enamel can be peeled off with a hot knife, when about 2 inches is so peeled and laid back to furnish an end to which a weight can be fastened. The sample is then placed in a testing cabinet whose temperature is kept at 150°. After 3 or 4 hours, the sample is placed with its ends supported and the coated side down and a weight of 2230 grams is fastened to the loosened end of the enamel sheet and gently released; and the time required for the weight to strip the enamel from a measured distance on the plate is taken by a stop watch.



Electric pot for heating enamel

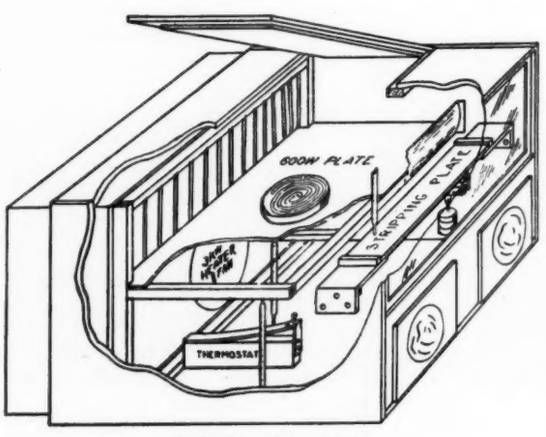
Comparing results of these tests on new type enamel and the old type coal tar enamel, the averages of three typical samples were as follows:

Results of performance tests on coal tar enamels

MATERIAL	SAG 24 HRS. AT 150°F.	TEMPERATURE TO CRACK	COLD BEND TEST AT 40°F.				SOIL STRESS
			Initial heating		After 1½ hours heating		
			Deflection to crack	Shatter area	Deflection to crack	Shatter area	
	inch		*inch*	*square inch*	*inch*	*square inch*	
New Type							
Sample 1..	0	Below 0°F.	0.470	1.4	0.300	2.7	Slight
Sample 2..	0	Below 0°F.	0.500	1.3	0.270	17.0	Moderate
Sample 3..	0	Below —20°F.	0.700	0.0	0.460	0.5	Severe
Old Type							
Sample 1..	9/16	+5°F.	0.170	17.0			Severe
Sample 2..	7/16	+5°F.	0.08	28			Slight
Sample 3..	¼	+20°F.	0.05	16			Slight

After a pipe has been coated, every square inch of the enamel is thoroughly inspected by the use of electricity at 15,000 volts impressed on it by means of flat brushes of fine steel wire which are drawn slowly over the surface both inside and out. One terminal of the transformer secondary is connected to the grounded side of the line and a lead from this is clipped to the pipe, and the other secondary terminal is connected to the wire brush. Bubbles, cracks and thin spots (less than about 0.04 inch) that cannot be seen are indicated by the flash and crackle of a spark, the spots are marked and hot enamel applied to them by hand. A similar test is made after the pipe has been placed in the ditch.

In backfilling around a pipe, hard objects are not permitted to fall on it. If there are any rocks in the backfill material, they are screened out, or other material without rocks is brought to replace it. No tamping, jetting or rodding with metal rods is permitted, but the backfill is settled by flooding and puddling.

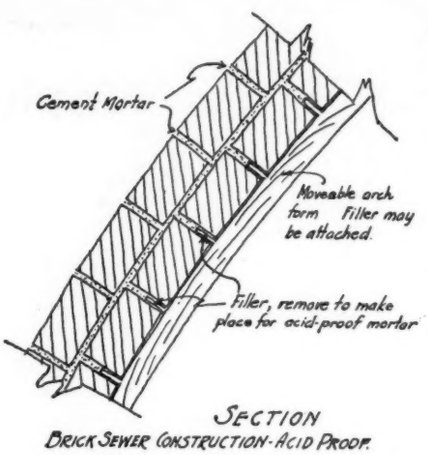


Stripping test cabinet

Acid-Proof Brick Sewer Construction

Brick, which are inert, are not affected by acids or by hydrogen sulfide gas, but the mortar used in making the joints is not always immune to this action. This problem of protecting the mortar can be handled by using a mastic of fused sulfur silicate mortar in the joints only, where it is exposed.

The sewer is constructed in the orthodox manner, using regular mortar for the joints in the invert below the flow line. Above the flow line, the regular mortar is placed only to within 1 inch of the inner circumference. This is accomplished by placing in the inner circumference joints a filler, as shown in the diagram, which is removed when the brickwork has set. The void is then filled with a mastic mortar or a fused sulfur silicate mortar, thus protecting the remaining joint material from gases or chemicals.


Cement Mortar
Moveable arch form Filler may be attached.
Filler, remove to make place for acid-proof mortar
SECTION
BRICK SEWER CONSTRUCTION-ACID PROOF

For the arch, this filler set can be attached to the movable form, and be removed with the form. Besides leaving this void for the protecting mortar, the filler aids the mason in laying the brick for the inner ring.

Meter Readers and Black Widows

In Newberry, S. C., H. W. Shumpert is bothered with the so-called black widow spiders in his meter boxes, spiders whose bite is said to be poisonous. He kills them by means of a mixture of 5 gallons of gas tar, 1 gallon of kerosene, and ½ gallon of orthodichlorobenzine or zol.

This mixture is sprayed into the meter boxes with a common hand pump, of the fire-hydrant type, through a four-foot garden hose with nozzle. The solution is sucked from a common 10-gallon open container. A lift stick can be used. At least ½ pint is sprayed into and around each box, more in larger boxes. First a shallow tin can is fitted over the register of the meter and then everything is sprayed.

Fig. 1. View of the waterworks intake under construction

New Waterworks Intake Saves $1500 Annually

By TROY E. WATFORD

City Engineer, Gadsden, Alabama

A NEW waterworks intake, which the city of Gadsden, Ala., is now constructing to bring water from the Coosa River, will so reduce friction and line loss as to save annually an estimated sum of $1500 in power costs for pumping. This work is being done by force account, through the WPA, with the writer in personal charge of the work for J. H. Meighan, commissioner of public works. The total cost will amount to about $37,000, of which the city's share will be about $9,000.

The original intake was through two 12-inch cast iron suction lines extending about 500 feet from the plant out into the river, this being necessary to avoid contamination from houses formerly fronting the river. These have now been torn down. The Coosa River water is treated with chemical, filtered and chlorinated.

The work is shown under construction in Fig. 1. When this was taken, the tunnel from the river to wet well had been completed and the wet well was being poured. The Coosa River is shown in the background. All the work was carried on by open cut. The average depth of excavation is 30 feet; near the pumping plant, it is 45 feet. A sectional view of the wet tunnel, wet well and suction pipe tunnel is shown in Fig. 2. The Coosa, in flood stage, will cover the top of the wet well, and because of this the roof is heavily reinforced and arrangements are made so that the valves can be operated from inside the suction tunnel.

Troy E. Watford

Practically all the excavation was in rock. This was drilled with air drills, blasted and excavated by hand using stages. The rock was stratified limestone. Timber sheeting was carried down to the rock. Sheeting, walks and the interesting methods of bracing are shown in Fig. 1.

The first step in construction was to drive a row of timber piling to protect the work from currents, wave action and debris. A double row of timber piling was then driven to rock or refusal around the wet well tunnel area, and the space between the rows filled with dirt. These rows of piling and the

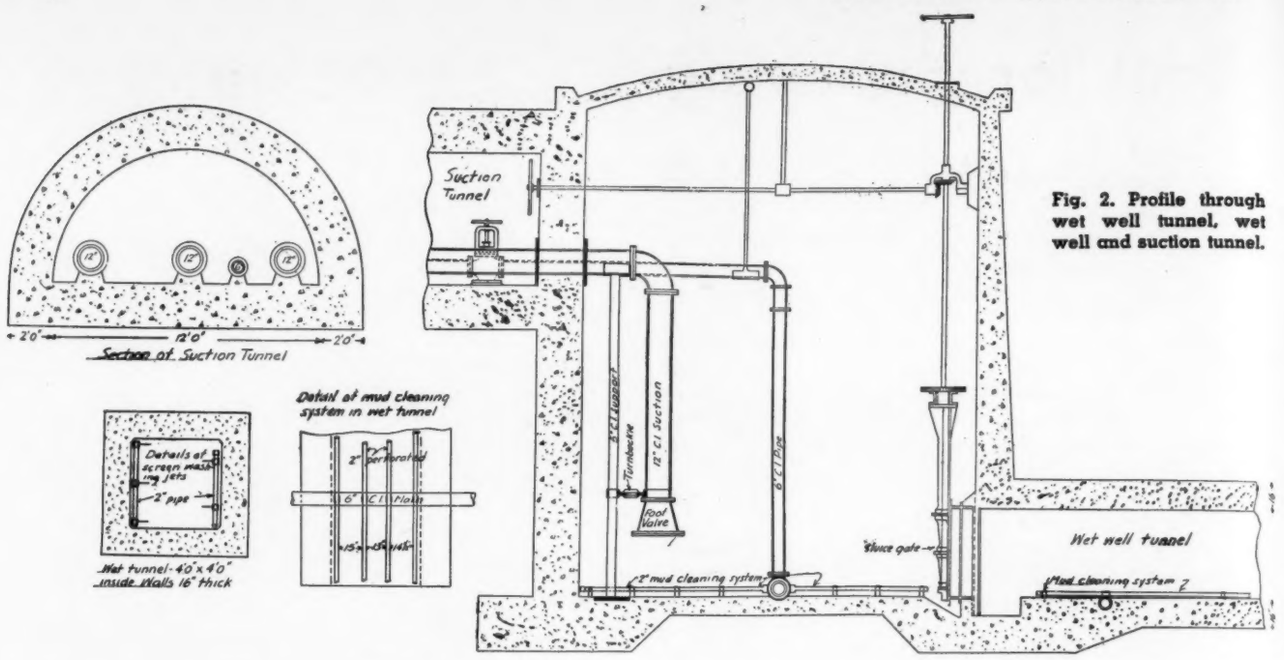


Fig. 2. Profile through wet well tunnel, wet well and suction tunnel.

dirt fill are shown indistinctly in Fig. 1. The wet well tunnel and the wet well were then excavated. Gasoline-driven centrifugal pumps were used to keep the excavation dry. The work was carried on in three shifts, floodlights providing light for night work.

Inasmuch as the wet well and the suction tunnel were in rock, coffer dams were not required, but pumping was required to keep the water under control.

The wet well tunnel was constructed in two operations. The bottom was poured first, and at the same time the bottom of the wet well was poured. The walls and top of the wet well tunnel and the wet well up to the bottom of the suction pipe tunnel were poured as another unit, and it is this stage that is shown in Fig. 1. The entire dry tunnel and the top portion of the wet well are being cast as a unit.

The wet well tunnel is 4 ft. by 4 ft and 25 ft. long. The entrance into the wet well is controlled by a sluice gate which can be operated from the suction tunnel or from the top of the wet well. The wet well tunnel is protected at the river end by wing walls and a 5/8-inch mesh copper screen. Two 2-inch pipes are provided in this tunnel, and are connected to jets for cleaning the screen. Perforated 2-inch pipes are also provided for washing mud out of the tunnel: a similar arrangement for washing out deposited mud is also provided in the wet well, this consisting of 2-inch perforated pipes placed 12 inches on centers. All these pipes are under control of the plant engineer. The cleaning system is fed by 6-inch cast iron pipes which carry a pressure of 140 pounds.

In operation, the water flows into the wet well through the wet well tunnel and is drawn up through three 12-inch cast iron pipes to the pumps, each line serving a separate pump, and is then forced to the filter plant. The wet well is 18 feet inside diameter and 22 feet high. The suction tunnel, 79 ft. long, is semi-circular, 12 ft. wide inside.

The materials required for the work included 100,000 pounds of reinforcing steel, which was rolled locally; 300 ft. of 12-inch, 300 ft. of 6-inch and 200 ft. of 2-inch cast iron pipe, all of which was furnished by the Alabama Pipe Co. of Gadsden; castings, foot valves, columns, sand, cement and stone. More than 700 cases of dynamite were required for blasting out the rock, and since much of the blasting was in close proximity to the existing filter plant, careful work was necessary.

An interesting light on the management of the job is that only one man was injured, and he not seriously. This resulted when a falling rock glanced from a negro laborer's head and struck another workman in the stomach, putting the latter in the hospital temporarily.

Nicholas S. Hill

Nicholas S. Hill, a past president of the American Water Works Association, died October 18th while riding from his home at Greens Farms, Conn., to the hospital following a heart attack. He was 67 years old.

Mr. Hill practiced as a consulting engineer for the past thirty years, specializing in water supply and public utility valuation. As such he was employed by many municipalities and private companies and in 1931 was retained to advise upon the financial administration of the waterworks of Shanghai, China. After having been consulting engineer to the Hackensack Water Co. for many years, he became president of that company in 1926, since when he devoted himself chiefly to the development of the Hackensack system, which serves a population of 400,000 in fifty towns and villages in northern New Jersey.

After graduating from Stevens Institute of Technology in 1892 he spent several years in Baltimore's sewer and water departments, being made chief engineer of the latter in 1896. From there he went to New York as chief engineer of the Dept. of Water Supply, Gas and Electricity. Among his other engagements, he served as chief engineer and general manager of the Consolidated Railway, Gas & Electric Co. of South Carolina; as consulting engineer to the New Jersey State Water Policy Commission; was supervising engineer in charge of construction of Camp Merritt during the World War, of the army transport terminal at Port Newark, and of the installation of sewerage and water facilities at Norfolk and Portsmouth, Va. In 1927 he was awarded the Thomas Fitch Rowland prize of the American Society of Civil Engineers for his paper on the Oradell dam.

The consulting business which Mr. Hill established will be continued by his associates.

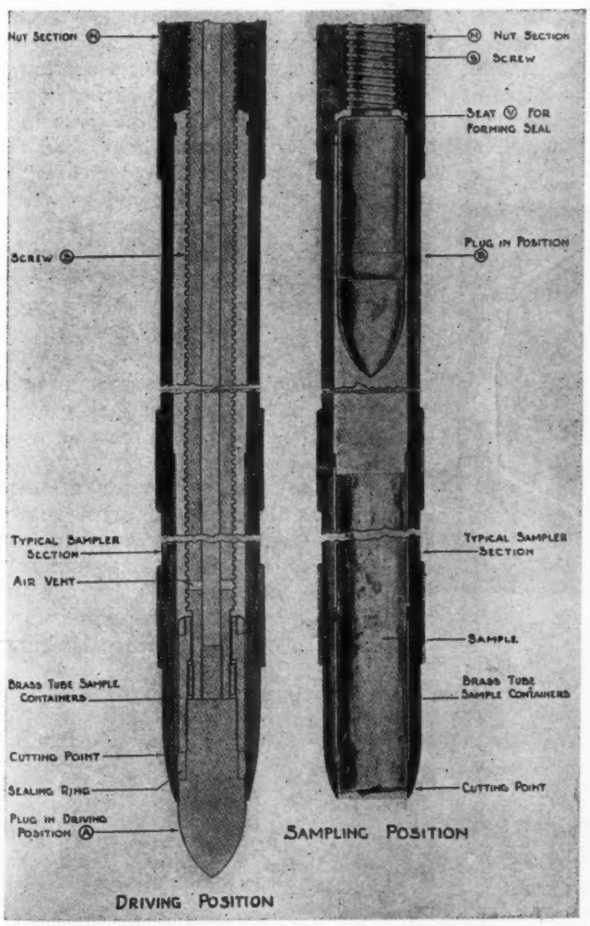
Tool for Exploring and Sampling Soils

..By C. F. GREEVES-CARPENTER
Photos: Courtesy California Highways and Public Works

AN IMPROVED soil sampler which was designed by O. J. Porter, Associate Physical Testing Engineer, and developed over a period of six years by engineers of the Materials and Research Department of the California Division of Highways, has given excellent results in sampling and exploration operations. It will obtain an undisturbed soil sample to a depth of 250′, so that accurate foundation conditions may be determined, especially the moisture content, density and consolidation of the sample.

Two-inch diameter core samples up to 4′ in length have been taken in one sampling to a depth of 200′ at a cost of less than $1.00 per foot, which includes equipment rental and operation. The power equipment operation of this size sampler is somewhat less than that entailed in the use of heavier equipment, and the 2″ cores have been found adequate for testing purposes.

Churn drill outfit and auxiliary A frame used in operating sampling tools on dry land.



Method of Operation: 1. Sampler driven to depth at which samples are desired with plug in position (A); 2. Plug raised to position (B) by turning screw (S) actuated by inside rod from surface; 3. Core obtained by driving sampler into soil thereby filling brass tube sample containers; 4. Plug raised above position (B) to contact surface (V) in nut section (N) to seal against suction; 5. Sampler pulled up and specimens removed, weighed, capped and sealed.

The sampler has been satisfactorily employed on all types of soil, ranging from sandy loam to "soft" rock, and even a slight distance into bedrock when disintegrated sandstone or shale were the major constituents. Another type, hand operated, which cuts cores 1″ in diameter up to 50′ in depth is used for preliminary borings by the Department with satisfactory results.

Casing is not essential for holes under 100′ in depth unless free-flowing sand or gravel is encountered, and is really only necessary when skin friction is too great to permit of facile operation in the drilling and in the removal of the sampler.

The unit has a cutting point of tool steel, with some five 12″ sampler sections, couplings, and several 2″ long brass tube sample containers which naturally allow for easy removal of undisturbed cores.

The plug assembly is the important element in this new tool for it not only plugs the sample until the desired depth is achieved, but seals the top of the sample against suction.

The procedure followed in taking samples consists of driving the tool in the form of a plugged tube to the desired depth. Once this is attained, the plug is retracted through the tube and the open sampler forced into undisturbed material. The plug is then further retracted to a point where it effects an air-tight seal above the sample, holding the sample in the tube when it is drawn up. The entire unit is then withdrawn to the surface, and the brass retainers are removed from the sampler sections and cut at the junctures between the retainers with a fine saw. The retainers are then capped, weighed, marked and paraffine-sealed to obviate any change in their contents before they are examined at the laboratory.

Jacking 54-Inch Concrete Pipe 79 Feet Under Railway Tracks

By LOWELL W. MONROE
Borough Manager, Ellwood City, Penn.

IN 1934 the Borough of Ellwood City, Pennsylvania, proposed to construct 1450 lineal feet of 48-inch circular section of storm sewer, 76 feet of which was to be laid under four tracks, (two of them main line tracks) of the Baltimore and Ohio Railroad Company. It was proposed to use Federal Relief labor, the borough furnishing all materials and tools. It developed during the negotiations that the railroad company would require its tracks to be adequately presupported at an estimated cost of $3,500, to be paid by the borough, thereby adding 35 per cent to the borough's costs.

In 1930 the borough had successfully laid 260 lineal feet of 66-inch pre-cast lock joint reinforced pipe by the jacking method, and it therefore asked permission from the railroad company to substitute 54-inch pre-cast lock joint reinforced concrete railroad culvert pipe in 4-foot lengths instead of the 48-inch as originally proposed, (flattening the grade in order to give the required clearance between the rails and the top of the larger pipe) and to jack or push this section without any presupporting of its tracks. It was pointed out that the larger section would expedite the removal of the excavated material, which would more than offset the time required for the extra excavation. Permission was granted with the following provisos: The work was to be under the supervision of the company's division engineer; it was to stop at once should ravelling develop, and the tracks be supported as originally planned before resuming work again; and lastly, it was to proceed as continuously as possible. This last proviso was desirable in that it lessened the possibility of the trench walls "freezing" to the pipe walls which, if it should happen, would probably stop any future forward movement of the pipe. Fortunately for the borough, nothing happened to necessitate reverting to the more expensive presupporting plan, the longest delay being six hours.

Lowell W. Monroe, Manager of Ellwood City

A storm sewer of rectangular section had been completed up to the tracks prior to starting work on the section under them and the end of this sewer was used to take the back thrust of the jacks, timber cribbing being placed between it and the base of the jacks. The excavation for the transition section between the rectangular and circular sections was used as a pit for mounting the jacks and skids.

Skids of 8″ x 8″ timbers were placed two feet apart parallel to the proposed grade under the tracks. They were 10 feet long in order to provide ample space for placing one joint of pipe, a timber bulkhead ring, and space for workmen to remove the excavated material brought back through the pipe already placed in line. Two 100-ton hydraulic jacks, series connected and operated by an electric motor-driven pump, were placed in such a position, parallel with both the alignment and grade of the track section, that the center line of their forces would meet the rim of the pipe at the lower third point of its diameter. Across the jack heads was placed a 4″ x 10″ timber tie to hold the jacks in a parallel position. This tie served another purpose, for when the jacks were fully extended it was found practically impossible to force the plungers back to an empty position without some mechanical aid. Therefore a one-ton chain hoist was installed, anchored back in the inside of the rectangular sewer and hooked to the center of this timber tie, by means of which the plungers were returned to an empty position by one workman while the other members of the operating crew were removing the blocking pieces.

Since the average length of each "push" was 12 inches, it was necessary to provide two complete sets of pushing blocks of various lengths up to four feet. These were cut from 10″ x 10″ oak and as the work progressed the ends became uneven, causing frequent buckling.

The four railroad tracks under which the 54-inch concrete sewer was jacked

Treated railroad ties were substituted for these blocks, and no further trouble was experienced. A bulkhead or cushion timber ring was made up of 6″ x 8″ green oak timbers bolted together as a double octagon, the purpose of which was to distribute the force of the jacks over a greater area of the pipe last placed.

A metal cutting ring made of 8-inch plate bent to the outside diameter of the pipe, with a 2″ x 2″ angle welded on the inside to prevent its sliding back past the end of the pipe, was placed on the forward end of the first joint. The purpose of this ring was not to cut, but rather to protect the end of the first joint from possible damage by the workman in excavating and removing earth and rock. A 12-inch hood was welded to the ring at its top to protect the workman from loosened material falling from the roof of the tunnel excavation before the pipe had been pushed forward to the face of the work.

The material under the tracks stood up well and usually it was possible to excavate from 16″ to 24″ ahead of the front end before making a "push." It was advantageous to excavate at least 12″ ahead in order to move the full extension of the jacks for each set-up of the pushing blocks. Before making each "push," two short pieces of 2″ x 4″ timber skid rails were inserted in the bottom of the excavation parallel to the grade, well greased to further reduce frictional resistance. The longest elapsed time between "pushes" after the work began was approximately eight hours; when delay was caused by motor trouble on the pump. The increased jack pressure to again start the forward movement of pipe already placed in line was quite noticeable. Except for the above instance, "pushes" occurred about two hours apart.

As the work progressed, some wet pockets were encountered in the bottom of the excavation which made it difficult to maintain a true grade. Whenever these pockets were encountered, it was thought best not to risk a longer excavation in order to place longer skids, but instead, a third hand-operated jack was placed so as to exert an upward thrust against the top of the front end of the first joint, thereby almost completely overcoming the tendency for the grade of the pipe to flatten. The designed grade for the 48″ sewer called for a rise of .54 foot in the 76-foot section, but when checked upon completion the rise was found to be .30 foot; but since the size of this pipe was larger than theoretically necessary, this sag in the grade is not seriously objectionable. The minimum distance between top of pipe and underside of ties was 3 feet.

A none-too-well observed "slow order" permitted all trains to proceed over the work without any appreciable delay. This train movement caused no great amount of material to settle upon and around the walls of the pipe between pushes, for no great amount of extra jack pressure was noticeable at any time when the forward movement was started other than what might be expected as the amount of pipe placed in line increased.

The normal operating crew, except at times when excavated material was being removed from the site of the work, consisted of the following: A foreman, a pick-man at the face or front of the work, a shoveler for loading dirt into a wheelbarrow and wheeling same back through the pipe to the jacking pit, and two other shovelers to remove the dirt from here to a storage pile. About one hour in each twenty-four was required for a power shovel and operator and a dump truck and driver to remove the day's accumulation of excavated material. This shovel was used also

Top—Looking down in jacking pit, showing jacks extended. End of box sewer at left, blocking between jacks and timber ring at right. Shows cable for closing pistons. Bottom—Timber ring in place against end of pipe.

Workmen removing excavated material from mouth of sewer. At right, timber ring moved back to jacks preparatory to rolling in the next section of pipe.

in lowering the joints of pipe into position in the jacking pit.

Electric lights instead of the miner's carbide lamp were furnished for the workmen in the excavation, and also for the outside men on the night shifts.

When the project had been presented to the County R. W. D. engineering staff for approval it was understood that no workman was to be permitted to work more than 36 hours per week, and that no Saturday, Sunday or night work was permitted except under emergency conditions. This portion of the project, however, was classed as an emergency, and extra men were called to provide for continuous operation.

The jacking portion of the project began on March 18th and was completed on March 25th, when 76 feet of 54-inch pipe had been put in place, being actually "pushed" 79 feet, the extra distance being needed to provide for the transition section.

The daily rates of jacking were as follows: 2 feet, 12 feet, 6 feet, 16 feet, 12 feet, 12 feet, 12 feet, 7 feet. During the six days of preparation for jacking the man-hours employed were: RWD portions; unloading pipe, 30; pit excavation, 50; setting rails in pit, 24; supervision, 60; trucks transporting pumps and jacks, 5 hours. During the eight days of jacking, the RWD man-hours were: removing obstructions, 12; excavating and removing earth, 515; jacking, including time removing and resetting blocking, 67; repairs to equipment, 8; supervision, 210; trucks, removing pumps and jacks, 5 hours; trucks removing earth, 10 hours.

The total costs were: RWD portion

Common labor, 744 hrs. @ 50c	$ 372.00
Supervision—General foreman @ $40 a week, foreman @ $25 and timekeeper @ $21.60	173.20
Truck rental, including driver, 20 hrs. @ $1.60	32.00
	577.20

Borough portion

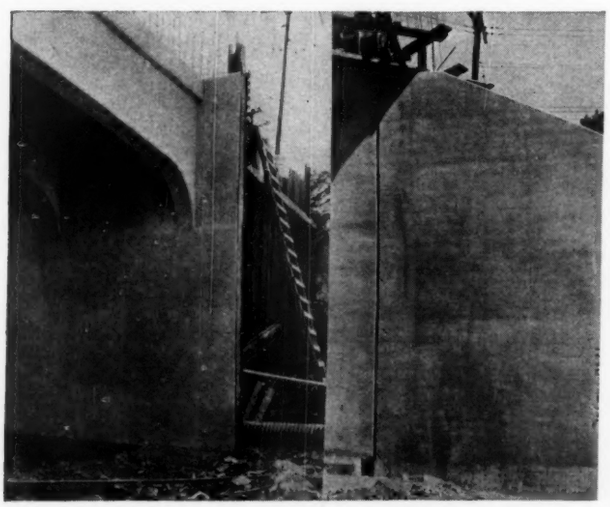
Skilled labor, 44 hrs. @ $1.00	$ 44.00
Gasoline shovel rental, 27 hrs. @ $2.00*	54.00
Rental of hydraulic pump and two 100-ton jacks	125.00
Concrete pipe, FOB Ellwood City, 76 ft. @ $7.92	601.92
	824.92
Total cost	$1,402.12
Cost per foot	18.45

*General foreman operated gas shovel.

The labor furnished by the borough comprised: setting jacks, pumps and transformers, 44 hours; gas shovel, handling pipe, 16 hours; gas shovel, handling earth, 11 hours.

The photographs are furnished through the courtesy of L. C. Blackwell R. W. D. staff engineer, Lawrence County, Pennsylvania.

The operating figures and cost are furnished through the courtesy of the local district Works Office.



Rubber expansion joint in bridge abutment

Analysis of 47-Year Old Asphalt Pavement

The oldest existing pavement in Fort Wayne, Ind., was laid in 1889. This was a sheet asphalt pavement, constructed on a concrete base, with a bituminous cushion course supporting the asphalt wearing surface, which was of Trinidad Lake asphalt, light flux oil, cement as a filler, and local pit sand as the aggregate. This pavement was laid on West Wayne St.

Fort Wayne's 47-year-old pavement

Records show that when this pavement was laid in 1889, the asphalt used had an average penetration of 63; samples recovered from the street in 1936 showed that the asphalt had a penetration of 55 at 77°—only a little harder than when laid 47 years ago. A method for determining the ductility was not devised until many years after this pavement was laid, so that no comparison is possible on this score, but the ductility of the recovered bitumen met present day tests for usage.

W. H. Droege, asphalt superintendent and materials chemist of Fort Wayne, has the records of construction on this street, which is still in daily use, as shown by the illustration herewith. The data were furnished us by R. C. Heath, of the Barber Asphalt Co.

Expansion Joints of Rubber Match Concrete Color

In building the new express highway in St. Louis, Mo., which required many bridges and retaining walls because of the numerous cross streets bridging it, especial attention was given to appearance. After careful tests, sponge rubber was chosen for the expansion joint filler, as this material does not extrude in hot weather. Thicknesses of the rubber for the joint vary from ¾ inch to 1 inch, being determined for each particular section by the cubic content of the individual sections of the concrete. The thickness of rubber is designed to allow 50% compression as the concrete expands in hot weather. All of the sponge rubber is supplied in a color that matches that of the finished concrete, which also tends to make the joints as smooth and unobtrusive as possible.

The left illustration herewith shows a rubber expansion joint attached to a bridge pier before pouring, and the portion at the right shows the joint permanently in place. The rubber jointing material was furnished by the B. F. Goodrich Co.

The Editor's Page

The A.W.W.A. Progresses:

Our congratulations to the American Water Works Association for its good fortune in being able to secure for the post of secretary, Harry E. Jordan of Indianapolis. Mr. Jordan will assume responsibility for the office on Dec. 1; in the meantime he is spending much of his time contacting water works organizations.

The new secretary is so well known among water works officials and engineers that a résumé of his accomplishments is not needed here. It is sufficient to say that as a water works man and as an official of the water works associations he has made a fine record; to this must be added a charming personality, and top-notch ability.

Everyone in the water works field can, and should, support Mr. Jordan wholeheartedly. He has a big job; he is probably the best man available for it. Once more, congratulations.

Profits From Sewerage

Many voters and many city officials look on sewer systems as one municipal project that brings in no revenue. They compare sewerage with the water works or the electric light plant, and think only of the fact that the sewer system costs money. J. D. Cook of the Clay Products Association has recently summarized some interesting data to show that this is a long way from the truth. Omitting from consideration such important advantages as health protection, improved living conditions, increased property values, convenience, etc., it has been shown that the construction of a sewer system usually more than doubles water revenue. In 132 towns in the Missouri Valley, the average cost of the sewer system was one-half that of the waterworks system. The permanently doubled revenue from water sales therefore represents a good investment on the money spent for sewers. Indeed, even though the cost of sewers was as great as for a water supply, the doubled waterworks revenue would still cover the cost.

While this is not a new idea, it is worth repeating from time to time.

The County Engineer's Work

This may be an age of specialization in engineering, but that is true only in the narrowest sense, and it does not apply to either the city engineer or the county engineer. Some two hundred of the latter have recently supplied us with data on their most interesting and difficult jobs during the past year, and previously about the same number of city engineers did the same thing.

Bridge and culvert construction, low-cost road construction and snow removal lead in interest among the county engineers; but there are numerous other kinds of work that these men are called on to do, including water supplies, dams, drainage projects, sewage treatment plants and sewer systems, earthwork and grading, maintenance, highway location, surveying, swimming pool design and construction, levee work, design and construction of stadiums and arenas, airports, county shops and garages, river bank protection, high-type pavements, and many more.

As shown in a previous statement on this page, the average county engineer is responsible for the expenditure of more than $100,000 a year; in many counties for ten times this much. He should be a good man, and he most generally is.

Use of Unemployed for Snow Handling

During the past two or three winters of the depression many citizens and editors of daily papers have remarked that the heavy snow falls were a blessing to the unemployed, as the city would hire them to remove the snow. But many cities, in the more northern States at least, have found that such employment had little to commend it to either the snow handling department or the laborers it employed. Working in the severest kind of weather, night as well as day, the laborers, most of whom lacked both suitably warm clothing and the vitality to resist the cold, suffered in spite of working as vigorously as they were able, and many of them contracted heavy colds and pneumonia. From the city's standpoint, these laborers, many of them weak and unaccustomed to such heavy work, made slow progress—much slower than if mechanical equipment were used; with the result that the officials were blamed for not sooner clearing the streets, and this delay many times resulted in the freezing or compacting of the snow, making it much more difficult to handle.

With this experience behind them, we believe that most street officials will, if permitted to do so, use as many mechanical appliances this winter as they can obtain; and that they will be fully warranted in doing so. In addition to the convenience to citizens of rapid removal of the snow, a direct saving in money may result. For example: One city using a snow loader finds 8 trucks with sideboards necessary to keep it busy. If the average haul to dump and back requires 15 minutes and if it takes ten men 15 minutes to load a truck without sideboards, then it would require 24 trucks and 120 men to remove snow as fast as 8 trucks and a snow loader; and if trucks are hired at $3 an hour and labor at 50 cts., the snow loader can be credited with $108 an hour; or, allowing $8 an hour for operating expenses and 100 hours actual operation a year, we have $10,000 a year to cover the repairs, interest and sinking fund for the snow loaders. (This is probably conservative. Some calculations give results two or three times this.) We could pay the 120 men and let them stay at home, and still have $4,000 to pay the overhead on the loader. But that would not be necessary; the laborers could be used at similar work on outlying streets where there is less necessity for haste, or in clearing cross-walks down town, before the removal crews reach them.

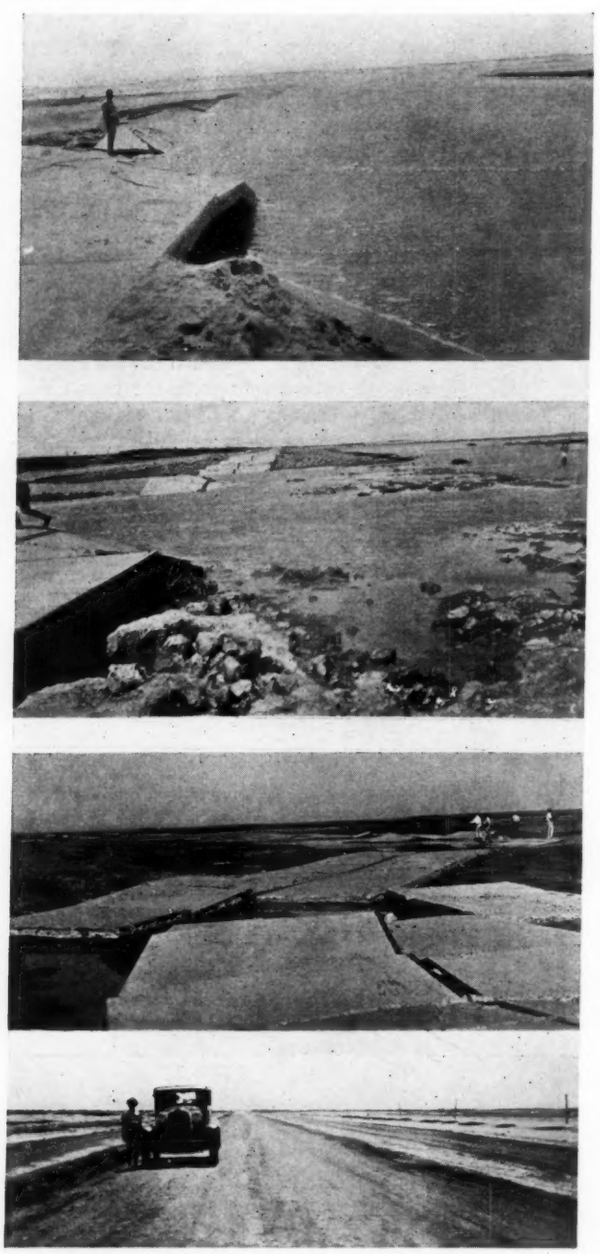
In fact, the need of speed in snow removal to prevent costly disorganizing of the traffic of a modern city requires the use of all the men and equipment that can be assembled and organized in the emergency; each piece of equipment will do the work of scores or hundreds of men, but no city has so much equipment that it can not also find use for all the labor available.

Repairing a Road Destroyed by a Hurricane

By W. O. WASHINGTON

County Engineer, Cameron County, Texas

THE tropical hurricane of September 4-5, 1933, which struck the southern tip of the Texas coast completed the destruction of about one and one-half miles of concrete pavement on the Boca Chica road, a county road in Cameron County, Texas.



Top — collapsed pavement, 1933. Second — channel washed across roadway. Third—displaced slabs of pavement. Bottom—road in 1936, showing flat side slopes and oiled sand wearing surface.

This road runs from Brownsville in an easterly direction to the beach of the Gulf of Mexico, crossing some shallow arms of the Laguna Madre near the Gulf shore. In constructing this road across these arms of the bay the concrete pavement was laid on well seasoned dragline fills raised about four feet above mean sea level. These fills were purposely kept low and had wide crowns and slopes of about 15 to 1, so that storm waters could pass over the road without destructive erosion of the fill.

The pavement was constructed in 1930, and storm waters from high tides had passed over it several times before the autumn of 1933, when two sections of more than one-half mile each were destroyed during a series of three tropical storms at one-month intervals.

The original ground surface was at about sea level elevation at these points, and for a depth of about four feet was fine shore sand, which was underlaid by hard firm clay. The fill was composed of a mixture of this sand and clay and the result was a good sand-clay mixture which made a fair all-weather road before it was paved with concrete. The mistake was made of not breaking up and mixing with clay the four-foot sand layer under the fill.

Failure of this pavement was clearly caused by collapse of the fill into the holes after the sand had been sucked out from underneath the fills by waters flowing over the road and into the borrow pits along the sides. There was no indication of failure from surface erosion or the force of the elements applied to the undisturbed surface of the pavement during the hurricanes. In fact, paving stakes and plow marks were found in the hard subgrade after the heavy concrete slabs had been pulled away by force of the water catching under the displaced and tilted slabs of concrete. Some of these slabs were carried like sails in the wind for over one hundred feet from original position and, in some cases, overturned. The pictures taken after each of the series of storms clearly show this collapse and removements of the slabs.

After the final hurricane it would have been very possible to salvage and replace the slabs in their original order on a reconstructed fill, but the financial resources of the county would not permit. Later, under the CWA program, a large part of the fill was replaced by truck haul under the direction of Cameron County. The concrete slabs which were not outside the roadway base were either broken up with sledges or were covered by the fill. These sections were used as a dirt road for several months until taken over by the State Highway Department.

In the early part of 1936, the Boca Chica road was designated as a state highway and taken over for maintenance. The dirt fills were then completed and a surface treatment of beach sand and asphalt oil laid down. This work is now nearing completion as a WPA project under the State Highway Department, under the direction of J. W. Puckett, Division Engineer.

Paving the American Canyon Cut-Off

Paving American Canyon cut-off, State Highway No. 7, California. Two paving mixers operating side by side placing a 20-foot cement concrete pavement. Three mechanical tampers are used. A vibrator is used from each side of the pavement ahead of the first finishing machine.

THE American Canyon cut-off is a realignment of a part of the road between Sacramento and San Francisco which shortens it by approximately 6 miles and eliminates five railroad grade crossings and passage through narrow, congested city streets of Vallejo.

The cut-off passes through American Canyon and involves difficult grading with nearly 1½ million cubic yards of excavation. The minimum radius of curves is 2500 ft., maximum grade is 6%. One cut is 2400 ft. long and has a maximum depth of 130 ft., and the major fill is 2500 ft. long and 80 ft. high. The grading was completed in 1934 and fills allowed to settle until last spring, when paving was begun.

The paving contract, let for $434,429, calls for applying a seal coat, placing selected material insulating course and paving with class "B" Portland cement concrete. Sealing required application to the subgrade of ¼ gal. per square yard of a liquid asphalt and ⅜ gal. of E grade asphalt. About 1.4 miles is paved with concrete 30 ft. wide, and 9.8 miles is 20 ft. Expansion joints are spaced 100 ft. with dummy joints 20 ft. apart and a weakened plane along the center line. Thickness, 0.55 foot at center and 0.75 foot at edges. The selected material under the concrete was 1 to 1.5 ft. thick for the entire width of the roadway.

The contractor established a permanent batching plant on the outskirts of Vallejo. Aggregate was delivered by railroad car, discharged into a track feeder and elevated by belt conveyor to the steel bunkers, which had a combined capacity of about 400 tons of aggregate. A shuttle belt along the tops of the bins provided for distributing the various grades of aggregate into the separate bins.

Aggregates were batched with weighing equipment operated automatically to prepare a 1 cu. yd. batch. This entire batching sequence operates by one lever on the control board, and does not require any attention except for a change in the mix. Trucks load under the central batching hopper.

A fleet of 25 to 30 trucks hauls the combined aggregate to the mixers.

Two mixers operate side by side on the 20-foot pavement, while on the 10-foot width, the two mixers operated in tandem. They are supplied by the aggregate trucks backing into postion and dumping directly into the skips of the mixers. Mixing water is supplied through hose from a welded steel line laid along the length of the job. Sacked cement is in position along the sides of the headers, ready to be emptied into the mixer skips. Between the mixers and the discharge from the buckets, the reinforcing steel, both transverse and longitudinal, is placed by a special steel crew

Immediately behind the mixers, a finisher with double screed carries out the first step in the finishing process. Mounted on the forward end of this machine are two gas-driven concrete vibrators which are used continually in vibrating the concrete mass ahead of the first screed. Behind this first unit, a finisher machine operates to provide a second stage of the finishing process.

Some distance to the rear, a third finishing machine, with single screed, carries a small wave of grout for the final machine finishing operation. Behind the screed, this machine carries a groover which cuts a 2-inch mark along the longitudinal center line of the paving, and the machine operator places 10-foot lengths of steel reinforcing bar in this groove, to a depth of about 2 inches, as the machine progresses. Immediately behind the machine, two men using heavy transverse markers prepare a groove to a depth of somewhat over 2 inches, into which is inserted the ¼ x 2 inch steel strips, at the transverse weakened-plane joints.

The next finishing operation is the longitudinal tamping float, operated from timber bridges. Following this is a crew of men operating transverse (bull) floats, followed by the finishers. In this last step, the steel at the weakened-plane joints is removed, and the reinforcing bar along the center line is also taken up, leaving a weakened-plane along the center of the slab. Following the last finishing step, the concrete placed during the day is kept sprinkled, and the next day covered with dirt, and water-cured in the usual manner.

Mr. A. N. Lund was the Resident Engineer in charge of the work for the State.

The above is an abstract of an article appearing in "California Highways and Public Works."

Catalytic Removal of Manganese at Brainerd

UNDER the heading "Removing Manganese from Water" we published in June, 1933, brief descriptions of processes in use for this purpose; among them that used in Brainerd, Minn., without the aid of chemicals. There "The water is forced upward through finely ground pyrolusite (containing about 70% manganese dioxide), then is sprayed onto a bed of small-size coke, where manganous hydroxide, formed by catalysis in the presence of excess air, is converted to stable manganic hydroxide and manganese dioxide in a finely divided condition. These coke beds collect 80% of the iron and manganese contained in the raw water. The manganese collected here acts as an additional catalyzer. The coke bed effluent passes through a sand filter composed of fine silica sand on a layer of crushed basic rock, which removes the iron and such manganese as escapes the coke bed."

An article in the July, 1936, issue of *Public Works* (abstract of a paper by W. G. Kirchoffer before the A. W. W. A.) described use of this catalytic process in several other places. On October 15th, at Springfield, Ill., W. D. McCay, secretary of the Brainerd Water and Light Department, read a paper describing the Brainerd plant and how it has been operating to date.

Among the details of the plant which he described are the following:

"Raw water is pumped through a 10″ cast iron main into the filtration plant. A 10″ Pisher liquid level control regulates the flow of water to the manganese chamber, and maintains the normal operating level in the coke chambers. The water leaving the manganese chamber flows over a weir, and into four 8″ supply lines leading to four copper aerating pans. The pans break up the water into a large number of fine streams, and permits it to absorb oxygen from the atmosphere as it falls to the normal level in the coke chambers.

"The water passes downward through a 30″ layer of graded coke and 18″ layer of graded trap rock in the coke chambers. It then flows to the sand chambers by gravity, International rate-of-flow controllers being installed to regulate the flow.

"After entering the sand filters, the water passes downward through the sand and trap rock beds and flows by gravity into the reservoir.

"For backwashing the two coke and two sand chambers, a 12″ cast iron connection was provided to the 18″ main leading from the main pumping station to the business district, thus making the water in the overhead concrete tank available for backwashing. The flow of water is controlled by means of 12″ hydraulically operated valves.

"The main drain line consists of a 14″ cast iron line in the pipe gallery, and a 16″ spiral riveted pipe line from the plant to the meadow where the wash water is wasted. Four concrete sumps are provided in the pipe gallery to receive the wash water and to eliminate any physical connections between the drain line and the various chambers."

Among the advantages he named are: There is no expense for renewing the coke and little back washing is needed. There is no need for coagulants, sedimentation basins or chemicals, or for skilled technicians to supervise. The only pumping required is for raising the water to the top of the building. The cost of treatment is almost negligible. The water used in Brainerd is from glacial drift, clear but moderately hard. It contains 1.0-1.2 ppm of iron and 0.7-0.8 ppm of manganese.

"The plant went into operation in April, 1932, and has been running continuously ever since. During all those four years not once has the effluent shown even a trace of manganese and only rarely does it show a trace of iron." Also the hardness—about 200 to 220 ppm—is decreased by 10% although this is not a contemplated result of the process.

No new help has been employed because of this plant. At the pumping station, prior to 1932, there was one man employed on each 8-hour shift, and that is all that is now employed. This man now and then walks from the pumping station to the purification plant to see if everything there is all right; the time so consumed is kept track of and totals 3 days a month or less, including the time required to backwash the sand beds once a month and to do janitor work.

The only big item of cost is the heating during the winter to keep the water from freezing. Other items are the cost of extra current for raising the water an additional 50 feet and for occasionally lighting the building; a trifle for incidental repairs about the building, and 3 days of operators' time per month. The ore bed has been emptied twice in four years to clean out the bottom.

Maintenance of Service Pipes in Springfield, Mass.

The Superintendent of the water department in Springfield, Mass., H. M. King, reported for last year that his division had cleaned 1073 service pipes, of the 23,068 connected to the system at the end of the year. "Our water has the effect of filling up galvanized pipe after a period of years. For some years back we have been using cement-lined pipe and also brass, which in time will overcome this trouble to a large extent." There were 177 leaks in service pipes.

One hundred and fifty-two old service pipes were cut off or abandoned—more than usual, owing to the large number of buildings that have been torn down. "Cutting the old services off when of no further use saves digging up the streets to repair leaks which are bound to come if they are left alive."

All main gates were operated during the year and repairs made where necessary. All hydrants were inspected two or three times a week during freezing weather. Twelve services were frozen. One hundred and seventy meters were frozen, 140 in cellars and 30 in tile.

Sewers Show Profit

The general fund deficit of Bowling Green, Ky., decreased $16,756.39 during the fiscal year ending May 31, auditors reported to the City Council. Profit from sewer operations cut the deficit $4,730.63.

Laying concrete pipe in close-sheathed trench in Toledo.

Beginning open cut behind the University of Toledo buildings.

Large Sewer Construction by WPA

By WILLIAM B. SCHMUHL
Director, Works Progress Administration, Toledo, O.

ONE of the large sanitary sewers in the vicinity of Toledo, O., now being constructed by the Works Progress Administration, involves installation of four miles of concrete and cast iron pipe through all types of ground, under highways, streets and tracks.

This intercepting sewer parallels Ten Mile Creek, which flows through Toledo's finest residential district, through the University of Toledo campus, and through sections of four of the city's great public parks. The abutting residential district, comparatively new, has been discharging its sewage into this stream. A serious odor problem has resulted, the odors under certain conditions being detected several miles away. and all fish life in the creek has been killed. This was approved as a WPA project, with a contribution of $324,555 from the Federal Government to supplement $50,000 supplied by the county.

To insure speedy completion, 625 WPA employes, all but 39 of whom were taken directly from the relief rolls, are working in five gangs of two shifts each. Work on the project began on March 9th.

Between the 26 manholes on the project, the sewer is straight and uniform in grade. About two-thirds of the line is in tunnel, the remainder being open cut. Depths range from 17 to 44 feet, through soil varying from sand and blue clay which may be dug out like butter, to extremely hard, yellow crumbling clay. The character of the soil changes at intervals as short as 50 feet, mainly because of the frequent fills that have been made along the creek in the past.

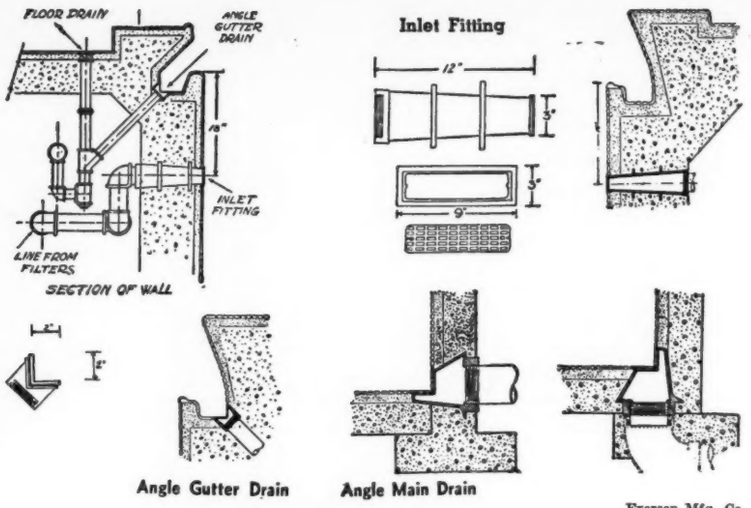
Hand labor is being used wherever possible. Hand windlasses are used to hoist the buckets of tunnel dirt to the surface. The concrete pipe sections, 39 inches in diameter and 4 feet long and weighing a ton and a quarter each, are lowered into the tunnel by four-leg, sulkey-type derricks, then pulled into place on tracks and rails laid in the bottom of the tunnel, power being furnished by the windlass in the next manhole.

Joints are then cemented, inside and out, to stop infiltration of ground water. A cement mortar collar of 1:1½ mixture, 2x8 inches, is placed on the outside of each joint.

It was necessary to employ mudsills, legs and caps in several sections and beneath all streets tunneled under. Below Bancroft street and the Toledo Terminal Railroad the mudsills, legs and caps were packed solidly.

Quicksand, encountered well toward the end of the open-cut section, increased the difficulty of maintaining efficiency. Many braces were added, and sheathing was driven below the trench bottom to stop the flow of sand and water. Several gas-driven two-inch and three-inch centrifugal pumps take care of the water in the worst places. Elsewhere, hand-operated diaphragm pumps are used.

Suggestions For Designing Swimming Pools



Everson Mfg. Co.

Some details of pool drains and inlets.

Safety

NEXT in importance to sanitation is safety. According to the California regulations:

Construction, appliances and operation shall be such as to reduce to a practical minimum the danger of drowning and of injury to bathers from falls or collisions. Pools should be constructed of concrete, masonry or tile. The sides of the pool should be vertical and have a smooth finish. Pitch of floors should be not over 1 foot in 12 feet where the depth of water is under five feet, this being the usual limit of wading depth.

Surrounding each pool there shall be a hand hold or hand rail.

Each pool shall also be provided with well-drained sidewalks of cement, tile or terra cotta or other impervious material whose surface is rough enough to minimize slipping thereon. Width of walks around the pool and in hallways should be at least four feet. A greater width, however, is recommended. Walks shall be laid to drain to the scum gutter or other drainway not easily accessible to bathers. Pitch should be at least ⅜ inch per foot. Use of a curb surrounding a pool is inadvisable unless the walk behind it drains to the rear to a gutter or drain openings to which bathers have no access.

Convenient stairs or ladders, preferably with treads rather than rungs, whereby the bathers may quickly leave the water shall be provided at each pool.

Low diving boards should not be placed over water having a depth of less than 6 feet 6 inches, but a greater depth of at least 7 feet for a distance of, say 10 feet in front of such spring boards is advisable for safety. Diving stands for high dives should not be placed over water having a depth of less than 8 feet 6 inches.

All pools used at night shall be provided with an adequate system of artificial lighting that will illuminate all parts of the pool and the water therein.

In addition to the pool itself, it is necessary to provide dressing rooms and toilets; also showers, which each bather should be required to use before entering the pool. Drains from these to the sewer must be provided; also from the pool, so that it can be emptied rapidly for cleaning or repairs.

Buildings and Appurtenances

Concerning the buildings and appurtenances, the California regulations require:

Adequate and proper toilets, urinals and showers for each sex shall be provided within all dressing room buildings, or in the absence of a dressing room building, then in close proximity to the pool. All change rooms shall have adequate toilets and urinals for each sex. Such facilities should be located in close proximity to aisles as they approach the swimming place. Except in the case of change rooms, the rooms in which such facilities are placed should open to interior hallways or aisles, and not to the swimming pool proper.

Toilets shall be of a waterflush type whenever possible, and shall be provided with means for the sanitary disposal of the sewage. Use of privies shall not be allowed. Chemical toilets may be used provided there are means of disposing of the contents without menace to health or the creation of a nuisance.

At least one shower and one sanitary fixture should be provided for each 80 dressing rooms and/or lockers.

Floors in men's toilet and urinal rooms should pitch at least ⅜ inch per foot to floor drains located at the rear of the room, to prevent undue contact between the feet of bathers and the soiled floors. Floor finish shall be smooth-finished cement mortar, tile or other impervious floor finish.

Sanitary drinking fountains utilizing the slanting jet principle with surrounding guard, and under adequate pressure, should be provided at convenient points.

Construction. Walks and floors of change rooms, dressing rooms, and of hallways, which are apt to be wet, should be constructed of roughened cement, tile, or other impervious material, and should be devoid of cracks or crevices. Such walks and floors should be laid on an even pitch of at least ⅜ inch per foot. All floors should drain into covered sanitary drainways and preferably to basement-type floor drains. A system of water piping with frequent hose bibs should be provided to enable the flushing of all floors.

Buildings should be constructed and finished in a workmanlike manner. Interior surfaces should be smooth finished and kept painted with heavy coats of paint, preferably light-colored. There should be adequate ventilation and artificial or natural lighting throughout, including toilet and dressing rooms. Dressing rooms should be roomy and not front onto the pool but instead onto hallways.

Waste water from the pool and its operations shall be disposed of in a sanitary manner, and without polluting sources of drinking water.

Spectators should be kept separate from bathers, and spectators' galleries should be built to prevent fouling of the pool water by dust and debris from the galleries.

Public swimming pools should be kept enclosed so that bathers do not have access to unclean surfaces, such as earth, lawns or artificial sand beaches, from which the bathers may track dirt and offensive material back to the pool.

Construction Details

Most pools are constructed of reinforced concrete, the plans and construction methods being similar to those employed for small reservoirs or other water containers. The corners should be well reinforced, and rounding to a radius of 12″ or so will add much to strength against cracking. Walls up to 50 ft. long probably need no expansion joints; over 200 ft. such joints are desirable. Between 50 and 200 ft. desirability of such joints depends upon strength of concrete, amount of reinforcement, climate or other conditions controlling amount of temperature variations. The floors will generally rest at their outside edges on footings of the vertical walls. Expansion joints, where used, are generally tongue and groove made watertight by insertion of a vertical crimped sheet of copper. The concrete should be made impervious by proper propor-

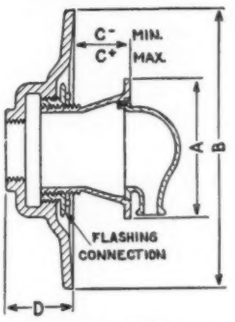
tioning and mixing, or the use of one of the compounds sold for this purpose.

The walls and floor should be covered with tile or other glazed, or otherwise very smooth and perfectly impervious, surface to prevent the ingrowth of any organic impurities in the water and to make easy the complete removal of any adhering matter. In some cases the concrete is painted with Inertol or other coatings which dry with a smooth, watertight surface. At least one pool has been lined with reinforced "gunite" shot against the sides of the excavation dressed carefully to exact surface.

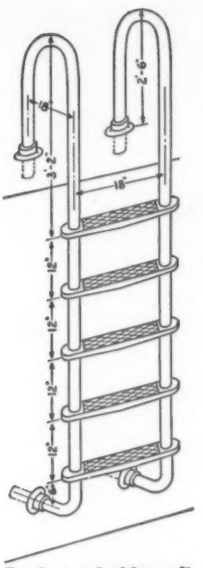
The wall is made vertical and continuous except for a scum gutter, the edge of which is at the water level; drains in the bottom (frequently in the angle between bottom and side); inlets, generally placed a foot or two below water level; and openings for underwater lights about a foot below; also in some cases connections for suction pool cleaners (similar to vacuum cleaners in operation). There should also be steps or ladders—generally the latter—to give entrance to the pool. The gutter drains, inlet piping, vacuum piping and underwater light boxes are placed behind the wall, and may be made accessible by constructing a pipe gallery around the tank; or by placing them in a channel below the sidewalk to which access is had by removable sidewalk slabs. All of these appurtenances can be had from a number of dealers in such fittings—The Everson Filter Co.; American Foundry & Mfg. Co., and others. All are usually made of brass, polished or nickel or chromium plated. Where the pool is lined with tile, special tile for forming the scum gutter can be obtained. Inlet, outlet and subsurface lighting units are set in the concrete when it is poured, care being taken to protrude the exposed face to the exact position of the finished surface.

Scum gutter drains are made flat or slightly dished and placed in the bottom of the gutter, or angled to fit the bottom and back of same. They are usually spaced 8 to 12 ft. apart. They are made 1½″ to 4″ wide and 3½″ to 12″ long, with areas from 8 to 50 sq. in., depending on rate of overflow to be handled and spacing. Main outlet drains are much larger, one or two being placed at the lowest part of the pool floor. They are generally flat and either round or square, but can be had angled for location at the side walls. The area is generally about 50 to 125 sq. in. All drains commonly are made with removable strainer plate, giving access to drain pipe for cleaning, etc.

Ornamental pool inlet.



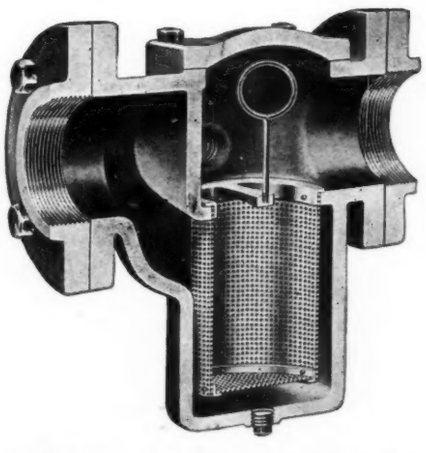
Fresh water inlet connection.



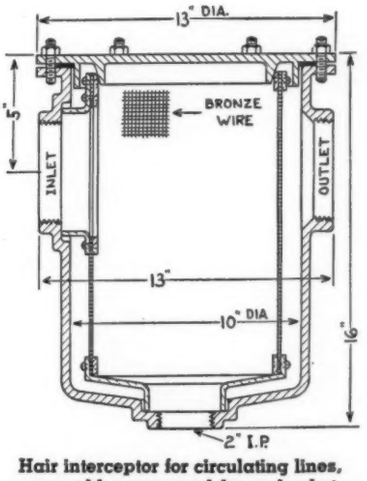
Pool step ladder, all brass, polished or nickel or chromium plated. American Foundry & Mfg. Co.

Inlets are of various types, some flush with the wall, others protruding several inches; most of them plain, but occasionally ornamented. In mose cases the face plate or orifice head is removable, being attached by screws or by screwing into sockets—preferably the former. Some send the water in a horizontal fan-shaped spray through a slot or a line of round holes—the skimmer spray. Others direct the stream vertically downward. Some use both kinds so as to be able to control the circulation in the pool; say, two of each in each end of the pool. Attachments for vacuum cleaners, if used, should be not over 40 ft. apart or 20 ft. from the end of the pool, placed in the side walls just below the scum gutter. Underwater lighting units are set in the side walls not over 10 ft. apart, with the center about 18″ below the water surface; the light being directed horizontal where the water is 5 ft. deep or less, and slightly downward for greater depths. Everson lights use 500-watt mazda lamps, with holophane lenses and silver reflectors, the unit set in a wall opening 13¾″ square.

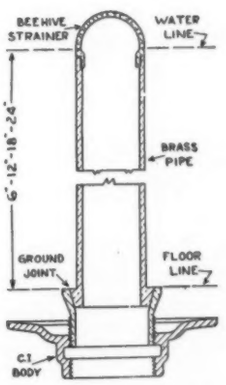
Equipment for circulating, purifying and heating the water will be described in the next instalment.



Hair and lint catcher placed on suction side of recirculating pump. Permutit Company.



Hair interceptor for circulating lines, removable cover and brass basket. American Foundry & Mfg. Co.



Drain with removable overflow connection.

Inverted Siphon Installation at Appleton, Wisconsin

By F. E. FULMER
Resident Engineer

THE intercepting sewer system for the City of Appleton, Wisconsin, includes an inverted siphon across the Fox river at a location where the river is approximately 800 feet wide and the depth of water varies from six to eight feet. The War Department permit for crossing the river required that the outside top of the structures for the major portion of the crossing be placed twelve feet below mean water level.

Hydraulic Design Considerations

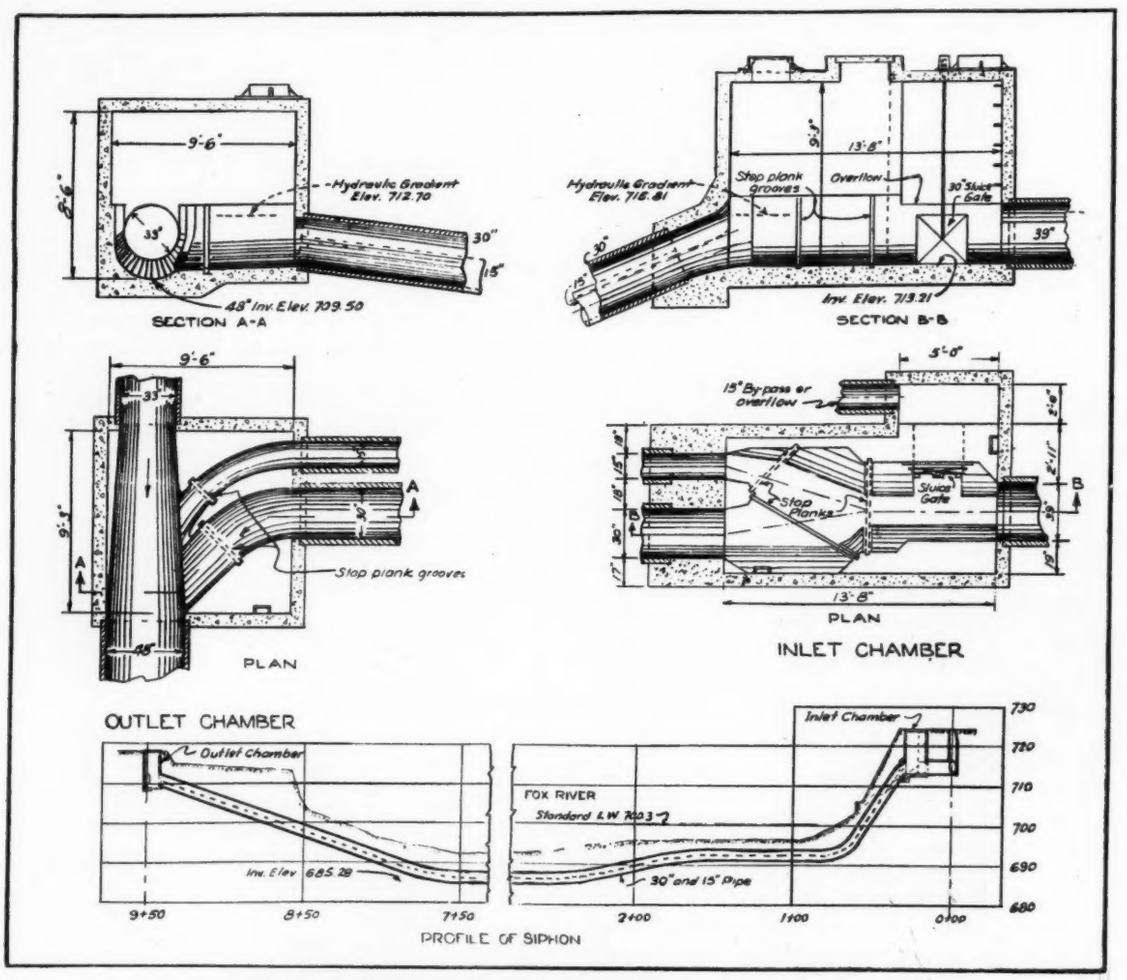
In order to prevent deposition under widely varying flow conditions, it was deemed best to install two pipe lines so that sufficiently high velocities could be obtained without undue head losses. Consideration was given to several different combinations of sizes, with the final selection of a 15-inch and a 30-inch pipe. The total head loss for this combination of pipes was within the available head range for the crossing and also resulted in satisfactory velocities for the assumed conditions of flow.

Under a maximum anticipated flow condition of 17.4 m.g.d., the total head loss for the crossing between the 39-inch sewer on the north side and the 48-inch on the south side is 3.11 feet, with the 15-inch pipe carrying 2.4 m.g.d at a velocity of 3 feet per second and the 30-inch pipe carrying 15.0 m.g.d. at a velocity of 4.7 feet per second. The minimum estimated flow is 1.25 m.g.d. which, when carried in the 15-inch pipe, will produce a velocity of 1.5 feet per second.

Pipe Lines

Inasmuch as both the inlet and outlet chambers were necessarily located a short distance from the river's edge with their invert elevations several feet above the water surface, it was apparent that the most economical design was that of laying the pipe out from the structures at an angle dipping towards the required elevation for crossing under the river bed. The angle of slope was determined by keeping the top of the pipe a safe distance below ground surface to prevent freezing of the sewage. To avoid unnecessarily deep excavation outside of the navigable limits of the river, approximately 120 feet of the pipe from the north shore was kept at a higher elevation than the remaining portion to be laid under the river.

Soil conditions and the depth of cut made it difficult to judge which of two general methods of construction



Profile of crossing, plan of inlet chamber and plan of outlet chamber

would be the most economical, that is, excavating and laying the pipe without dewatering or building a cofferdam and dewatering. If the first method was followed, cast iron pipe could be installed to best advantage, while the latter method offered the opportunity of using reinforced concrete pipe. For this reason bids were taken on alternate pipe materials, one with cast iron pipe permitting the use of flexible couplings and the other with reinforced concrete pipe. Both alternates specified concrete encasement of the pipe with permission to use the tremie method for placing concrete under water. The lowest of four bids received on the cast iron pipe alternate was $50,868, while the lowest bid received on the reinforced concrete pipe alternate was $48,928.

Inlet Chamber

The inlet chamber is arranged for placing wood stop planks across the channel leading to the siphon pipes and by-passing the flow through a 30-inch square sluice gate to a 15-inch pipe laid on a steep grade to the river. The dividing wall between the by-pass compartment and the main channel is built up only to the height of the incoming 39-inch sewer to provide a means of overflow in case of stoppage or excessive flows. If it is found desirable or necessary to place a coarse bar screen ahead of the siphon, it can readily be done at any future time by putting the screen across the main channel in the stop plank grooves. Removable slabs in the roof of the structure will also permit the addition of a mechanically cleaned screen if desired. The diagonal stop planks across the channels to each pipe permit some regulation of the flow according to what will be the most desirable height under the normal flow conditions. It is anticipated that all low flows will be continuously diverted to the 15-inch line and any flows in excess of its capacity, without causing backwater in the main sewer, will pass over the longer diagonal weir and into the 30-inch line. Occasional diversion of the total flow to the 30-inch line will be desirable to eliminate the possibility of any appreciable accumulation of deposits in this line.

Outlet Chamber

In an effort to retain a smooth flow at the junction of the siphon with the 48-inch sewer, channels with bottoms shaped to the bottom of their respective siphon pipes were built on uniform bends. To help eliminate eddies from carrying sediment back into the pipe not in use, the invert elevations of the 15-inch and 30-inch pipes were arbitrarily set at 0.7 foot above the invert of the 48-inch sewer. As a further precaution, stop planks can be adjusted in height across the channel to eliminate eddies or to close off the line entirely for inspection or repairs.

Construction Method

Actual construction was started January 18 on the lower end of the crossing but due to severe cold weather and ice only 192 feet of pipe and the outlet chamber had been built up to March 1. Between this date and June 23, the date of completion, the inlet structure and the remaining 725 feet were installed. The pipes were laid within steel piling cofferdam sections approximately 185 feet long and 22 feet wide. The nature of the river bottom, which consisted for the most part of hard blue clay mixed with various sized boulders and small stone, permitted excavating a trench within the cofferdam to only the approximate width required for the pipe section without any appreciable caving of the banks between the trench and sheeting. A small ditch was made on top of the unexcavated material parallel and adjacent to the sheeting and all the seepage at this point drained thereby to sump pumps at one end of the cofferdam.

Top—First cofferdam section from North Shore of river 2nd—Method of laying pipe on precast concrete blocks 3rd—Water proofing pipe joints. Bottom—Pipe in place on vertical curve ready to be encased with concrete.

The encasement required 6 inches of concrete under the pipe, and in order to make a monolithic pour the pipe was laid on precast concrete blocks. The laying of the pipe above the trench bottom also permitted space for making a good joint on the bottom part of the pipe. Standard 4-foot lengths of reinforced concrete pipe with tongue and groove joints were used for both sizes of pipe.

Pipe Joints

What is believed to be a new and unusual method of waterproofing pipe joints in sewer work was used throughout the job in the following manner: The bell and spigot of each pipe were buttered with mortar in the usual manner, followed by filling and troweling the joints smooth with mortar for the full circumference of the pipe, both inside and outside. After the mortar had taken its intitial set, the joints for a width of approximately eight inches were given an asphaltic priming coat followed by a hot mopped coat of asphalt. Over this coat an eight inch width of special waterproofing fabric was applied over the joint and then followed by another hot mopped coat of asphalt. Inspection of the joints in the 30-inch pipe after the backfill had been made and the sheeting pulled gave every reason to believe that this made for an unusually water tight line, considering that the bottom of the pipe was under as much as a 15-foot head of water pressure.

After the crossing had been completed it was filled with water to the invert elevations of the pipes at the outlet chamber, which is approximately ten feet above river level. Measurement was then made of the drawdown of the water in the pipes over a five hour period. The leakage from both pipes to the river under this test amounted to 271 gallons per hour, equivalent to 0.037 percent of the discharge capacity of the crossing.

Construction Cost

A breakdown of the final construction cost according to the contract items is as follows:

Inlet chamber, including 15-inch by-pass and 39-inch connection to north side sewer	$ 1,923.00
Outlet chamber	764.00
917.6 linear feet of double pipe line	38,539.20
917.6 linear feet of concrete encasement	6,992.11
78.4 cubic yards of rock excavation	784.00
Total	$49,002.31.

Personnel

The construction work was performed by C. R. Meyer & Sons Co. of Oshkosh, Wisconsin, with Baldwin Meyer in charge. The crossing was designed and the construction supervised by Greeley & Hansen, consulting engineers, Chicago, with F. E. Fulmer as resident engineer and Alfred Wickesburg, division engineer. M. C. Everett was resident engineer-inspector for PWA, which aided financing the project.

Above: Brick parking strips on Lake St. (U. S. 212), also car track paving. Right: View showing installation of vitrified brick gutters with asphalt pavement, using 2½-inch vertical fiber lug brick, on Fourteenth Street, Minneapolis.

Sewerage Work of the WPA

Sanitary and health projects carried on by the Works Progress Administration during the period 1935-36 include 5,384 sewers, sewage systems, and sewage and garbage disposal plants, in addition to work done during the period 1933-35 by the Federal Emergency Relief Administration on similar projects.

The local authorities who submitted the projects and sponsored them provide 21 percent of the funds for the work by paying 49 percent of the cost of the materials used and 5 percent of the cost of the labor employed.

Some idea of the extent of these projects may be had from the estimate that the work, if not "staggered," would keep 399,200 men busy for three months, or 1,000,000 men busy for five weeks.

This program is supplemental to the work done under the Federal Emergency Relief Administration during the period of 1933-35 when 242 sewage and garbage disposal plants were constructed; 277 such plants were improved with needed repairs; 1,888 miles of sewers were built; and 793 miles of sewers were repaired or improved.

Sheet Lead to Reduce Vibration on Underpass

In the construction of a small underpass at Golden Gardens, Seattle, Wash., sheet lead was used to reduce the vibration from trains of the Great Northern Railway. The bridge is of precast and precured concrete slabs resting on steel girders. The railroad bed and ties rest directly on the top of the concrete.

Between the concrete slabs and the steel girders, sheet lead plates, one-eighth inch thick and 13 and 15 inches wide, were inserted. The lead is used primarily for minimizing vibration, but it also provides a perfect setting for the two materials, compensating for any surface irregularities.

The engineering staff of the Great Northern and the city engineer's office of Seattle cooperated in this work, which was constructed by the Cascade Construction Co. of Seattle.

Brick Parking Strips in Minneapolis

Minneapolis is using brick for parking strips along the curbs on some of its bituminous paved streets. Such construction on Fourteenth St. and on Lake St. are shown in the illustration; the car track paving also being brick in the latter. These strips are 4 feet and 6 feet wide, respectively. It is the usual practice to make the brick strips wide enough to catch oil drippings from parked motor vehicles.

The brick used were of the vertical fiber lug type with asphalt filler, the excess of the latter being removed at the time of laying. The brick are 2½ inches thick and are laid longitudinally, which obviates batting and makes it easy to secure a smooth, even grade.

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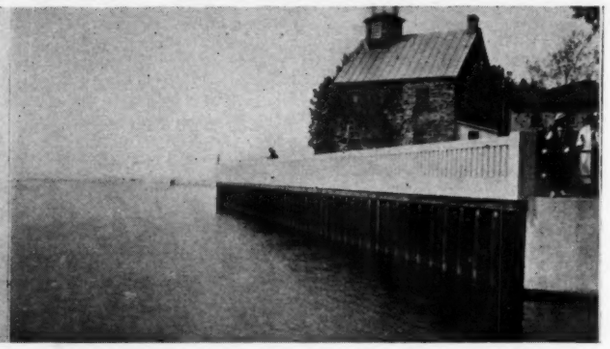
Roadway around old "lighthouse"



Looking down Salmon river, showing piling

Highway Protection with Steel Sheet Piling

By M. D. EWELL
County Highway Superintendent, Oswego County, N. Y.

SELKIRK LIGHTHOUSE is located at the mouth of Salmon River on the shore of Lake Ontario, three miles from the village of Pulaski, New York. It was built by the U. S. Government in 1838 at the entrance to Port Ontario Harbor, which was then an important lake port and gave promise of developing into an active, industrial city.

The lighthouse was operated by the federal government for several years but the plans for the industrial city were never developed. In due time, the lighthouse came into private ownership and, with a substantial addition, was remodeled into a summer hotel. Also, since that time, numerous cottages have been maintained on both river banks and along the lake shore.

Access to the hotel and cottages was gained by a narrow road near the water level and between the lighthouse and the river shore. Due to storms and changing river levels, this road was often flooded and therefore became a constant source of danger. Later, as public travel increased, the elevation of the road was raised and the river front protected by a timber crib, erected by the town of Richland; also, a hard surfaced road, leading from Pulaski to the lake shore, was built by the town with county aid.

During the winter of 1934-35, wave action caused by lake storms undermined the timber crib, which was considerably decomposed, and made a section of road around the lighthouse impassable.

At a special session of the County Board of Supervisors, held on August 9, 1935, County Road Project No. 47 was set up and $12,500 appropriated "For the construction of a steel sheet pile retaining wall to protect the highway from wash by Salmon River and Lake Ontario and replace an existing timber crib."

The Problem

The conditions to be met were as follows: The shore formation consists of a shifting sand and gravel which is constantly being altered by the combined action of both lake and river. Water in the river channel at the deepest point is about 12 feet with a fairly rapid current. During the winter season, ice banks and jams are prevalent, due to the junction of lake and river. For these reasons, a stable form of construction had to be provided—one that would extend well below the river bottom and resist all erosive actions of river current and lake waves; also, a structure that would be of pleasing appearance and, at the same time, be a protection to highway traffic.

The plan developed consisted of an interlocking steel sheet piling face which would extend well below the river bottom and would be tied back at about water level to a concrete "dead man" placed below the roadway, well inside the sheeting line. The tops of the steel sheeting would support a concrete cap and railing. Adjacent to the concrete cap would be a narrow concrete sidewalk and curb for the protection of the railing, pedestrians and cars. Roadway pavement would then be placed against this curb. The plan provided for an angle of 30 degrees directly opposite the corner of the lighthouse, with two straight arms leading from this point; one of 97 feet extending past the hotel front along the lake shore and one of 147 feet extending up the river. Provision for lights on the end and angle posts were provided on the arm in front of the hotel.

Construction

Actual construction work was started on August 22, 1935. Work began with the excavation of what remained of the old roadway to a grade about 1.0 foot above lake level and for a distance back from the proposed face of the sheeting of 13 feet. Along the back of this excavation was then placed a continuous block of concrete, having a cross section 3 feet square. Imbedded in this concrete mass were 1¼-inch round anchor rods set at 5-foot intervals and projecting horizontally at right angles toward the sheeting line at an elevation 5′ 6″ below the sheeting top. These anchor rods were set true to line and grade with the projecting ends at a uniform distance of 7′ 7″ back of the sheeting line. The ends of these anchor rods were provided with 3″ threads to receive the ends of standard turn buckles.

As soon as the anchor concrete was properly set and the forms removed, a horizontal wale (composed of two 8″ channels, separated 1½″ by cast iron fillers) was set up on false work at the elevation of the anchor rods and with outside flanges at the inside sheeting line. This wale was then securely fastened to the stub anchor rods by means of turnbuckles and connecting 1¼″ round rods 6′ 9″ long, supplied on the outer ends with

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St. Germain Street, St. Cloud, Minn., paved with Stanolind Cut-Back Asphalt after street car track was removed.

First Street, St. Cloud, Minn., wood blocks replaced with Stanolind Cut-Back Asphalt and a 4½" mixture of crushed granite.

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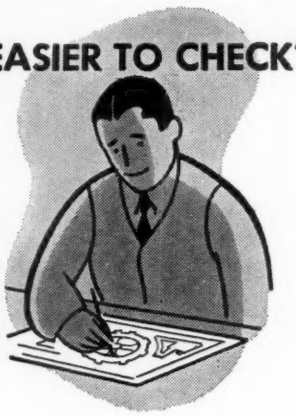

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12″ threads and double nuts, which engaged both sides of the wale and held the whole construction rigid.

The next operation was the driving of the sheeting, using the wale as a driving guide. Care was used to see that the piles were not driven more than 2″ below grade. Driving was followed closely with an acetylene burning outfit, with the aid of which every second pile was securely fastened to the wale, using 1″ bolts. Tops of piles were held in true alignment by means of two 8″ channels, one inside and one outside, each double bolted at all points of contact. The top flanges of these channels established a true grade as well as forming a wider base upon which to cast the concrete coping, which was readily anchored by bolts to these channels.

At this time, fill was placed to the bottom of the pavement grade and allowed to settle over the winter before placing the pavement. A concrete coping 1 foot high by 1′ 2″ wide was cast, resting upon and anchored to the top channels. A solid, concrete railing 3′ 6″ high was cast upon and anchored to the coping. Elastite expansion joints were placed in coping and railing at about 15-ft. intervals.

In the spring of 1936, as soon as weather was suitable, a 2′ 6″ wide concrete sidewalk and curb was cast on the fill along the inside of the coping; a penetration macadam pavement placed and traffic resumed.

Steel was furnished by the Kalman Steel Co. of Buffalo, N. Y. The sheeting used was furnished in lengths of 18 ft., 21 ft. and 24 ft., their section AP-8 being used. Plans were prepared by the writer and all work was done by force account by the Oswego County Highway Department.

Burlap for Subgrade Road Reinforcement

By R. C. PERKINS
District Engineer, Arizona Highway Department

BACK in November, 1934, we were having plenty of trouble with an old oil cake between Globe and Cutter on U. S. Highway 70. The cake was torn up and laid down on an average of once every two months and in some places oftener than that.

As Texas and South Carolina were experimenting with cotton matting we decided to try burlap, which was the only material available. We bought No. 2 barley sacks in two and four hundred lots. These sacks when split open make a mat of nine and a half square feet and cost six cents each.

The old cake was torn up and laid aside, the subgrade was shaped up and a spray of hot oil (about one-eighth gallon per square yard) was applied. The burlap was then laid upon the newly prepared subgrade and another application of hot oil (eighth of a gallon per square yard) was applied to the burlap in place. The old oil cake was then laid upon the burlap in the usual manner.

Just what action the burlap has we do not know, but the oil cake that was placed on the burlap is still in place and in good condition. The oil cake on each side of the burlap has been torn up many times and is now being placed on burlap.

Whenever we encounter bad clay mud subgrade we use burlap, as described above, and so far with good results. In the summer of 1935 we started to repair the old oil cake in the Claypool tunnel, which is situated on U. S. 70 between Superior and Miami. This tunnel is hewn out of the solid rock but, as usual with all

Arizona rock, is full of seams which, in this case, carry water nearly all year.

The old cake had been replaced and added to until in places it was at least a foot thick. The subgrade in the tunnel is the worst kind of clay and always wet. It was a problem to repair the old cake and keep traffic moving. The road could not be closed because the only other road serving this territory was the Apache Trail, a crooked, narrow mountain road with many bridges that could not carry the heavy traffic.

One half the tunnel was torn up at a time, the subgrade shaped and the same procedure used as stated above. Before the burlap was used it had been necessary to repair the oil cake at least once a week; it has now been eight months since the burlap was used and only some minor repairs have been made, and these were caused by water pouring in from the top of the tunnel.

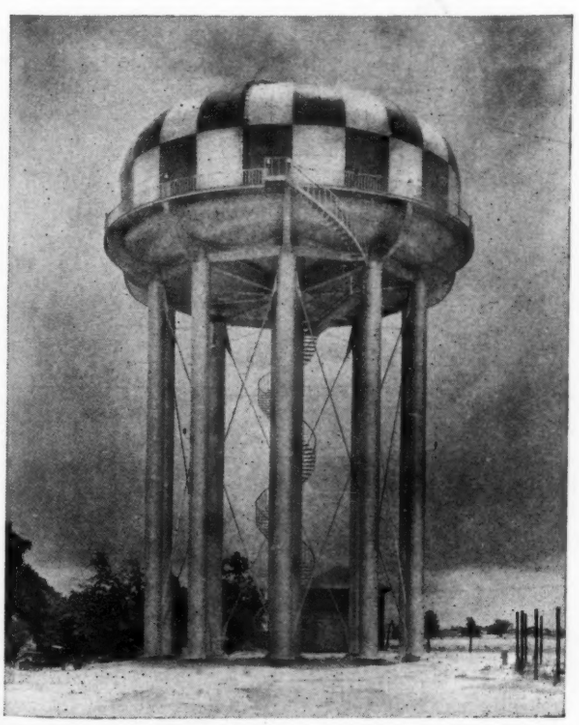
The surface is in good condition and does not show any signs of cracking and going to pieces, as it has always done before.

It seems the burlap forms a waterproof mat and also has a marked tendency to form a subgrade reinforcement.—*Arizona Highways.*

Air-Way Markings for Water Tanks

Water tanks, gas holders and similar structures which by reason of location, size or height constitute a hazard to air navigation should be painted with a checkered pattern of International orange and white. The alternate blocks should be square, with the length of each side equal to approximately one-seventh of the longest dimension to be marked; but the squares should not exceed 30 feet in size, or be less than 10 feet.

Smokestacks that are unusually high or lie directly in an air-path should be painted with horizontal bands of International orange and white. The width of the orange bands should be one-seventh of the height of any tower less than 250 feet high and between 30 and 40 feet for heights greater than 250 feet. The white bands should be half as wide as the orange bands; and orange bands should be at both top and bottom.



Airway marking on 500,000-gallon water tank at Augusta, Ga.

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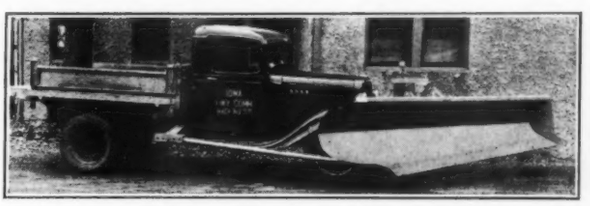

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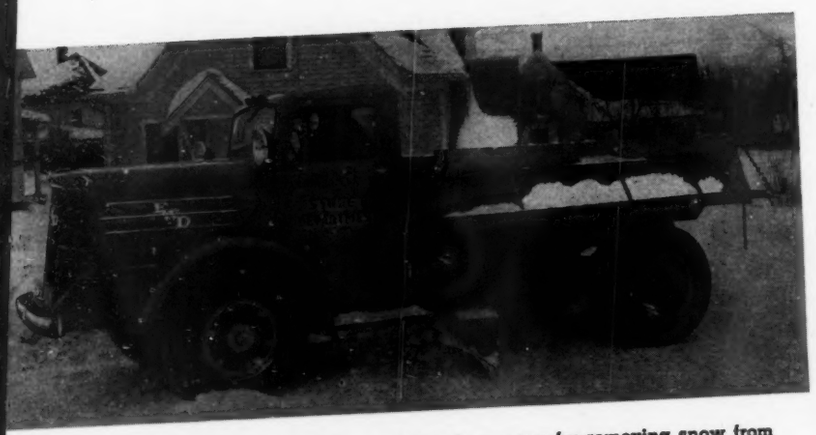

W D de luxe road maintainer, utilizing underbody scraper for removing snow from city streets

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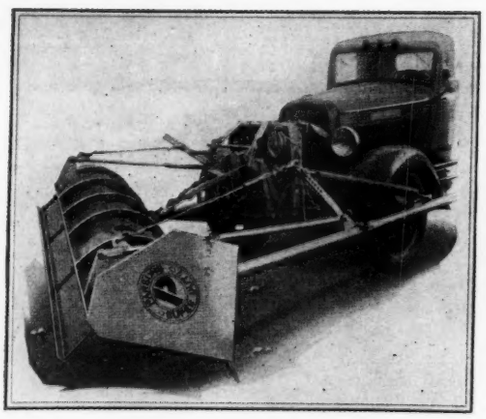
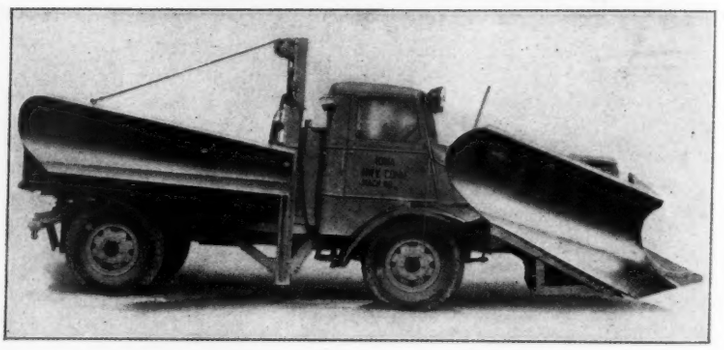
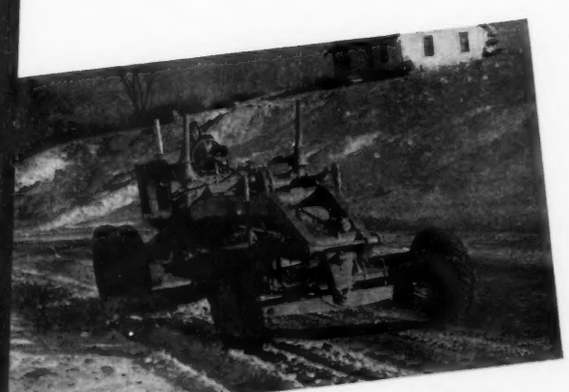
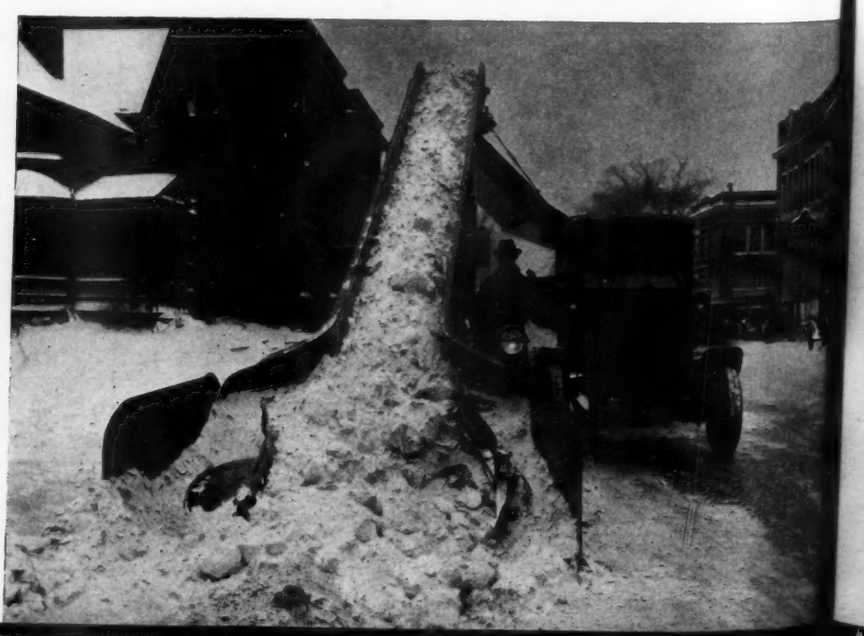




Below: A Joy snow loader in action



"Caterpillar" Diesel scarifying and blading ice



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Don't forget the READERS' SERVICE DEPT.—pages 55-57

Maintenance and Snow Control in Grundy County, Iowa

By J. W. WIERSMA
County Engineer, Grundy County, Iowa

GRUNDY COUNTY, located in the central part of the State of Iowa, is a strictly agricultural county consisting of fourteen townships in which are nine towns, five important community centers and twelve rural community churches. The county has a valuation of $23,000,000 and a population of 15,000. As an agricultural county it ranks first among the 99 counties in the State.

We have a total of 860 miles of secondary roads, 310 of which are surfaced. Our 1936 maintenance fund will be $95,000 and our construction fund will be $98,000, all of which is derived from a property tax with the exception of $45,000 which is the county's prorated share of the State gas tax of 3 cents per gallon.

For maintenance purposes we have divided our roads into fourteen patrol districts, with a patrolman in charge of each district. He is equipped with a power maintainer, fresnos, picks, shovels and other miscellaneous tools, all of which are housed in insulated sheds located in the approximate center of his district, electric lighted and equipped with a work bench, underground gas tank, pump and stove.

In replacing this equipment we purchase two new maintenance units each year, so that no unit is more than 7 years old and it is not necessary to buy any great number of units at one time.

Besides these outlying maintenance sheds and units, we have a central hollow-tile shed and yard located at Grundy Center (the county seat), which is used for storing lumber, culvert pipe, snow fence, etc. The shed houses one 4-ton truck and plow, two 1½-ton trucks and two power-driven maintainers. It is also equipped with a work bench, miscellaneous tools and is heated with a furnace. The one power maintainer is known as our "Pinch Hitter" and is available for any one of the patrolmen should his unit happen to be in need of repairs.

All of our equipment is inspected and overhauled each fall and winter, with only one unit being repaired at a time.

Our winter maintenance program is worked out as follows:

Starting early in the fall, all patrolmen make certain that all grass and weeds are cut from the shoulders of their roads, that all ditches are well opened, that tile intakes, outlets and culverts are open and functioning properly, and that all weeds and brush have been cut from the right of way. Snow fence is then erected along places on all graveled roads where drifting is apt to occur. This is erected by each patrolman in his own district, after being hauled out by trucks from the central sheds.

This fall we are planning to equip seven of the newer power patrols with V-type snow plows. These seven units, along with our four-wheel-drive truck plow, two "Sixty" Caterpillar tractors with hydraulic controlled plows, and one Model L tractor with hydraulic controlled plow, will constitute our snow fighting equipment.

A Ross "60" on a Grundy county road.

All light snows will be removed at once with the fourteen power maintainers. If slight drifting occurs (more than a blade can handle), two adjoining patrolmen will double up and use one power unit with the plow attached and if necessary use the second unit for a pusher. When conditions become such that these units are no longer able to open their roads or cannot make more than a one-way track, our three large Caterpillars and four-wheel-drive truck will be put into action.

These units will be operated 24 hours a day, using three shifts of two men each. They will be operated over routes charted by the county engineer and will be in touch with the engineer's office constantly. They will not be operated during storms, as is the practice on most State highways, because funds will not permit and the mileage they must cover is too great.

The Board of Supervisors and this department feel that this is an adequate plan for the average winter in Grundy County and that it can be kept within our financial ability to pay.

Snow Removal in the Twin Cities

ALTHOUGH Minneapolis and St. Paul are but a few miles apart and presumably enjoy the same conditions as to snow and other climatic caprices, their methods of keeping streets travelable in winter differ somewhat, it would appear from the brief descriptions given by E. J. Lund, superintendent of streets of Minneapolis, and J. R. Johnston, assistant superintendent of construction and repair of St. Paul.

Minneapolis is divided into six districts for the supervision of plowing, removal and disposal of snow from roadways and sidewalks. Plowing is laid out in 27 truck routes, each having two trucks which plow together in the roadways. There are 146 routes for removing snow from sidewalks. Four mechanical snow loaders operate under the supervision of one street supervisor. Large patrol graders and heavy-duty tractors drawing combination road graders equipped with scarifiers are used to remove packed snow and ice when these form.

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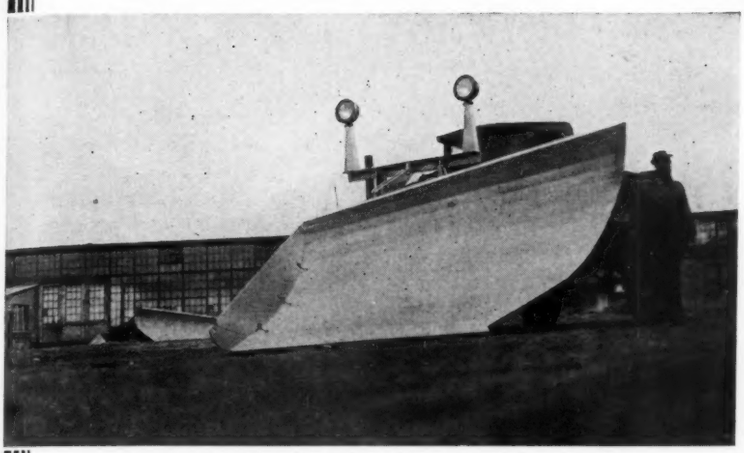

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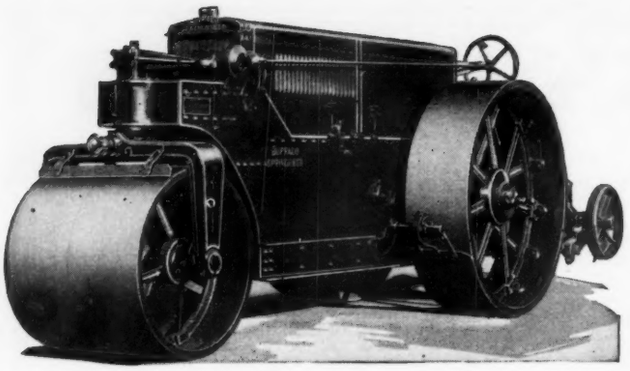

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Meantime the sidewalks on the 146 routes are plowed, mostly by teams pulling V plows, but several small tractors are used for this purpose.

Snow removal by hand in each district is in charge of a district supervisor, and the men are divided into crews. Each crew consists of one foreman, twenty-five laborers, and about six or eight trucks, depending on the haul. These crews clean up snow and ice at important intersections both in the loop and outer business districts. This class of work is performed during the night as well as in day time.

Each of the four mechanical snow loaders is supervised by one foreman who is given one small tractor equipped with a small one-way plow and two large tractors with combination road machine graders. These tractors are used to windrow the snow to be loaded by the snow loaders. About eight to twelve five-ton trucks are needed in connection with each mechanical snow loader, depending on the haul.

In St. Paul, snow handling is divided into plowing, removal from the streets, and sanding icy streets.

The regular street maintenance crews form the skeleton of the snow handling labor. In cases of severe snow storms this skeleton organization is supplemented by common laborers obtained from the civil service lists. Practically all of the semi-skilled laborers are civil service truck drivers.

The snow plowing equipment consists of 1½ to 5-ton trucks on which are mounted single-blade snow plows, tractors carrying V-wing plows, motor patrols with scarifying equipment and blades, and "snogos" for blowing snow from deep cuts. The plows are operated in batteries of two or three, one following the other, each battery assigned to a certain route.

The primary routes, which are cleared first, total about 200 miles of streets, which can be plowed in 12 hours with 23 units working full time. The secondary streets, comprising approximately 500 miles could be plowed in approximately 24 hours with 31 units working. However, as the city has only 29 units available it requires 36 hours to plow all the streets.

When ruts form because of delayed plowing or the freezing of wet snow, they are removed by motor patrols with scarifier teeth and blade attachments, and big scarifying graders drawn by heavy tractors.

Removal of snow from the streets is effected by trucks and hand labor and snogos. Snow plowed into side windrows is loaded by snogos into trucks and trailers in wide streets, by hand in narrow streets and intersections, and dumped into large sewers or the river. Where possible, snow removal is confined to the hours between midnight and 7 A. M. to avoid the interference of parked cars.

In the past, shoveling snow from sidewalks into gutters after the streets have been cleaned has added considerably to the cost and this winter it is proposed to plow the sidewalks before plowing the streets.

All steep grades and heavy traffic intersections are treated with cinders when at all slippery. Cinders collected during the summer are crushed and screened and stored in various yards, and spread both by mechanical spreaders and by hand, in some cases mixed with calcium chloride. Twenty to 25 thousand cubic yards of cinders are spread each winter.

Following is a digest of the important articles published last month having to do with water works design, construction and operation and water purification, arranged in easy reference form.

The Water Wheel

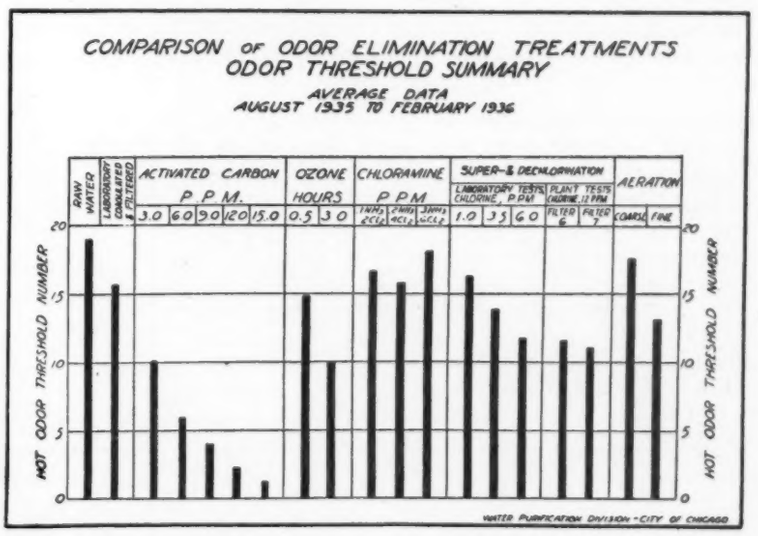
Water spreading is practiced in southern California by three general methods: Ditch or furrow, basin or pondage, and by wells or shafts. The ditch or furrow method is generally used in areas of very rough or sloping terrain and where the water at times may carry much silt. Advantages—low cost of maintenance and operation; handles more silt than any other. Objection, not more than 10% or 12% of total spreading grounds in contact with the water. In the basin method a succession of basins is made by building small dams at regular intervals across the natural abandoned channel, water flowing through them in series, the upper ones serving as silt ponds. Baisins average 100 x 400 ft. by 3 ft. deep in San Fernando Valley. To prevent surface sealing, basins are harrowed every 10 or 15 days. Wells and shafts are the most expensive method, give the least absorption,, and applicable only to those localities where clay or cemented materials overlie the water-bearing formation. Stream channel spreading is practiced on most major streams in southern California; diverting the stream flow over the broad flat sandy beds which are dry in summer, breaking up the beds by cultivators if they tend to consolidate or seal up. In some cases permanent dams are built across the channel which spread the stream flow into broad thin sheets. Unit rates of percolation for spreading projects for an entire season are not available.[A99]

Water spreading over absorptive areas for underground storage is still in its infancy. . . . It is not a cure-all. . . . Depending upon the location, duty it has to perform, and economy of operation, it may be adapted to many areas, and in particular to those basins in which the long-time natural recharge does not equal the demand for extraction.[F69]

Taste and odor removal investigations at Chicago (caused chiefly by microorganisms) were made, using activated carbon, superchlorination and dechlorination, ozone, ammonia-chlorine, and aeration; using the hot threshold method. The results are shown by the diagram. Mr. Gullans reports that "The data show that if the odor threshold is to be reduced to a value of 2 it is quite obvious that activated carbon treatment in some manner would probably be selected. It is also evident that a combination of superchlorination and filtration or one of the other treatments, would materially reduce the amount of odor and work to be done by the carbon, so that a combination of two or more treatments may prove to be the most economical in many cases.[G31]

Anthrafilt tested for a year at Bethlehem, Pa., in one of six filters, each 20′ x 18′ with 14″ of gravel and 26″ of sand or anthrafilt, "produced an effluent as satisfactory, or possibly slightly more so, as that of the sand filter, although the actual differences are not sufficiently great to warrant a definite statement as to the superiority of one over the other," comparison being made on the basis of chemical, physical and bacteriological characteristics of the effluents. "Filter bed expansion with resultant superior washing, coupled with economies in wash water consumption, show marked advantages in favor of the anthrafilt medium." Greensburg, Pa., has obtained practically the same results from both media, with longer runs and less wash water with anthrafilt. Hoover, at Columbus, O., found a light coating of lime on anthracite medium after 13 months, but this was easily rubbed off. In Wilkinsburg, manganese gives much trouble in sand filters but there has been no deposit on anthrafilt after 6 mos. operation. Anthrafilt is being used in 26 states.[X16]

Air conditioning consists of heating or cooling, adding or subtracting moisture, diluting odors and smoke, circulating the air, and removing dirt and odors. It is the refrigerating equipment that imposes the main requirement for water although some is needed for winter conditioning. In some plants the water is used over and over by cooling it in cooling towers, thus reducing water consumption about 95%, or still more by use of an evaporative condenser; but these require the use of power, which may cost more than the water. In localities without adequate water supply in dry seasons, 100% use of water conserving equipment is indicated; where supply is ample, pumping and purifying equipment may eventually have to be increased to meet the air conditioning demand; and where they are already



Comparison of Effectiveness of Various Odor Elimination Treatments—Lake Michigan Water

ample, concentration of air conditioning equipment in the business center may overtax the mains there. In Baltimore, four large stores during 77 business days of summer used 26 mg for air conditioning. A total of nearly 9 mgd is used in that city for air conditioning during the summer months.[A93]

Rolled-fill dams are now economic competitors of the hydraulic-fill dam, due to recent improvements in mechanical equipment for handling earth. They are not treacherous during construction, but if failure does occur it is when the structure is in service. The present tendency in rolled-fill construction is toward the use of scientific earth-testing methods, both in selecting the material and in control of construction. The author employs fundamental principles of soil technology developed from latest research and practice, supplemented by certain research findings in concrete technology. Mechanical analysis, combined with microscopic examinations and, in some cases, a simple mineralogical test, is proposed as a basis for determining suitability, possibly confirmed by tests for compaction and permeability. The principal requirements for the impervious part of such a dam, are permanent stability when saturated, reasonable water-tightness, and workability in spreading and compacting; also insolubility and reasonable cost of handling. "The selection of material from mechanical analysis data, although believed to be practical, is more or less preliminary in character at present and subject to modification as the result of more positive tests, such as compaction, permeability, etc."[K5]

Tar lining for cast iron pipe practically is condemned as indefensible by recent investigations, which showed at an age of 20 years an average capacity loss of 44%, and at an age of 30 years an average capacity loss of 52%; for those 16″ and larger the average coefficient at 20 years was 93 and at 30 years was 85, while for 4″ to 12″ pipe the coefficients were 55 and 45 after 20 and 30 years, respectively. "From present information it would seem reasonably safe to conclude that a sustained coefficient of 100 for sizes 12″ in diameter and smaller and of 120 for larger sizes may be estimated" for cement-lined and bitumastic-lined cast iron pipe and concrete pipe, or 50 to 100% more than is safe for tar-dipped pipe. Cost of cement-lining of pipe ranges from 4 cents per foot for 4″ to 90 cents for 48″; and of bitumastic coating from 7 cents for 4″ to $1.80 for 48″. Based on capacity 20 or 30 years hence, tar-dipped pipe is much the more expensive.[F68] Very definite indications are found that "pipe linings used in the 1880's have preserved the carrying capacities of pipes to a greater degree than those in use at later dates."[F67]

Garbage and sludge incineration, combined, is being installed at Frederick, Md. Calculation indicated necessity for little additional full. Incinerators were designed for manual firing and stoking. Drier between sludge filter and incinerator will be added only if experience indicates the necessity for it. The incinerator will consist of 2 furnace chambers, 2 combustion chambers, a pre-heater with carborundum tubes and stack; capacity, 60 tons in 24 hrs. (to be run 8 hrs.). Combustion chamber volume, 15 cu. ft. per ton per 24 hrs.; furnace chamber above grates, 11 cu. ft. per ton; effective grate area, 1.2 sq. ft. per ton; drying hearth area, 0.6 sq. ft. per ton; air for pre-heating, 5 lbs. per lb. of refuse; stack area, 0.25 sq. ft. per ton; stack height, not less than 85 ft. above grates; fire brick, not less than 9 in. where in contract with gases. To fire started each morning with accumulated wastes, a mixture of garbage and sludge cake will be added. Combustion gases will flow around the outside of about 90 carborundum tubes, through which air will be drawn from stoking and charging rooms by induced draft and discharged below drying hearths at about 400°[X4]

Plant nuisance seems to be eliminated in the carefully operated activated sludge plant at Rockville Center, N. Y., as "proven by the new construction of high-class residences directly adjacent to the plant. The plant grounds are also used as a park and some of the effluent percolation beds that have not been required since the installation of the vacuum filters (substituted for the difficult and odorous percolation pits) have been converted into a skating pond." Total solids determinations are made daily on the returned sludge and mixed liquor; and as a check, at least once each shift the sludge depth at center and sides of the settling tanks is determined. Dissolved oxygen determinations are made daily or oftener on the mixed liquor in the aeration tanks. B.O.D. and solids determinations are made daily throughout the plant. The porous aerating tubes are back-washed at least once every two weeks. Aeration tanks are checked frequently for the presence of any settled material in the bottom. A full-time chemist is employed at the plant.[G28]

Trickling filters can apparently be increased greatly in capacity by use of more scientifically designed equipment, to judge by experiments at Minneapolis and Chicago. At the latter good results have been obtained with a rate of 20 mgd per acre. Conclusions from the Minneapolis test are that: (1) Rest periods are not essential—long ones are definitely injurious. (2) Loads of 20 mgd are practicable if properly applied. (3) Dosage of 7 to 10 mgd is not recommended because of danger of ponding. (4) Continuous dosing eliminates fly nuisance. (5) A fabricated tile filter medium is recommended for strong wastes as additional safeguard against ponding. (6) The growth of Fusariea can be controlled by soil inoculation. (7) Forced draft is essential during those seasons of the year when temperatures of air and water are about equal. Explaining (4), it appeared that filter flies stay on dry spots on the filter stone and will not emerge over wet stone. The fabricated tile in (5) is not described, except that it was "designed to prevent channeling" and "make unloading easier." For (7) the explanation offered is that "the only factors causing air to flow through a filter of this type are the difference in the temperature of the air and the liquid, and the difference in humidity of the air in the filter and the air outside."[G26]

Bibliography of Recent Waterworks Literature

c, Indicates construction article; *n*, note or short article; *p*, paper before a society (complete or abstract); *t*, technical article.

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September

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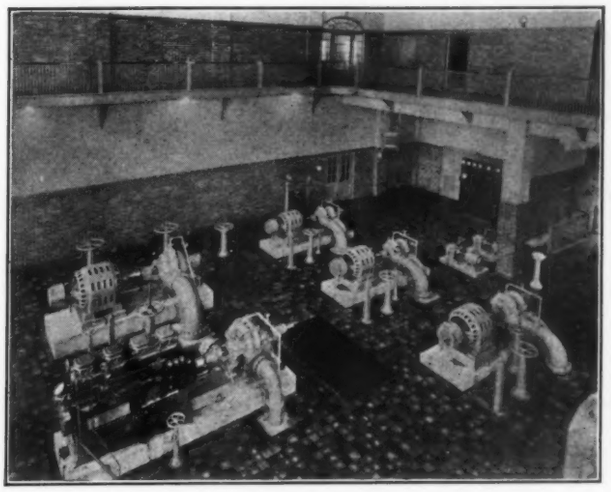

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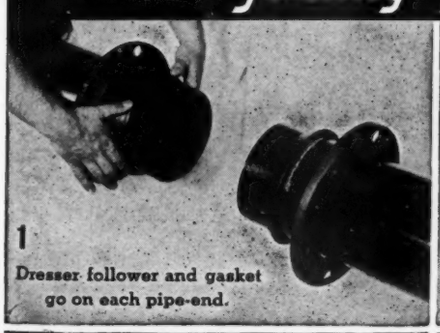
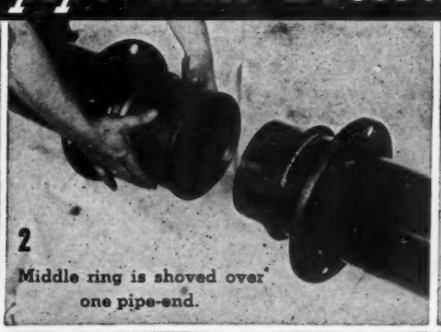
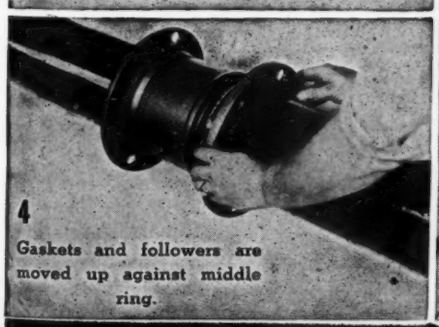


1 Dresser follower and gasket go on each pipe-end.



2 Middle ring is shoved over one pipe-end.

3 Other pipe-end is stabbed into middle ring.



4 Gaskets and followers are moved up against middle ring.

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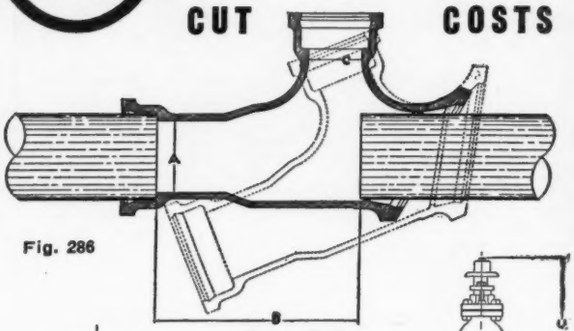

Fig. 286

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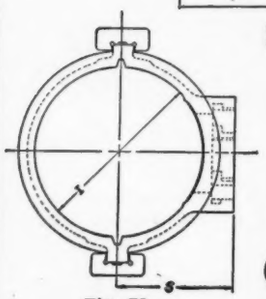

Fig. 72

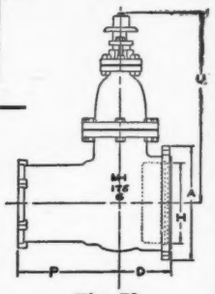

Fig. 73

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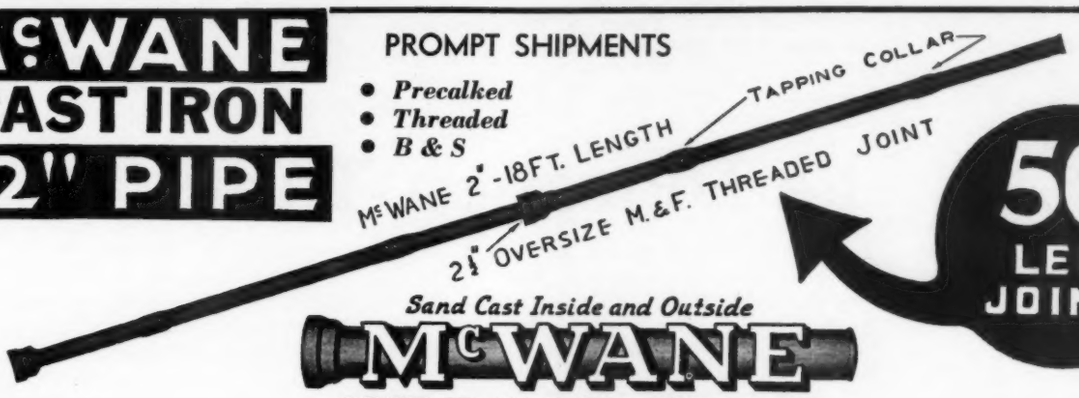

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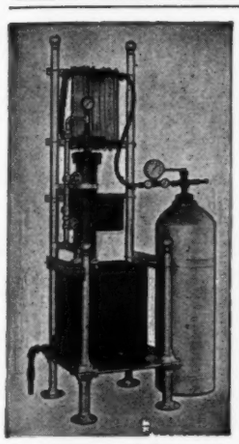

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A Digest of the Sewerage Literature of the Month giving the main features of all the important articles published

The Digestion Tank

Activated sludge treatments with compressed air and brush aeration were compared in two exactly similar tanks at Marlboro, N. J., under practical operating conditions; using Norton medium porous tubes placed 9′ below water level. During 22 months, 88 complete weekly analyses and 600 partial daily analyses were made. Conclusions: From the standpoint of purification, almost identical results were produced when 3,000 ppm or more of activated sludge solids in the aerators, but below this the brushes removed less suspended solids than compressed air but with little difference in B.O.D. removal efficiencies. But the settling and compacting ability of the sludge formed by the compressed air tanks was three times as great as of that formed by the brushes, and the latter therefore would require larger settling tanks and digesters. Whether this larger capital cost would be offset by lower operating cost is to be discussed in another installment.[C46]

Sprinkling filters operated up to 16 mgd per sq. ft. 6 ft. deep, and using different kinds of media, were tested at the Iowa Engineering Experiment Station. Rates of 2, 4, 8 and 16 mgd were compared, but the 2 and 16 were considered most reliably comparable (although sewage used for latter averaged 21% stronger on the basis of B.O.D., therefore equivalent to 19 + mgd). One filter medium was filled with 1″-3″ crushed quartzite, five others with burned clay forms; four of these were "Raschig rings" (hollow cylinders of equal length and diameter and only enough wall thickness to provide necessary strength) of ¾″, 1″, 1½″ and 2¼″ dimensions respectively, the fifth a special clay block similar to a hollow building block 2½″ deep. The ¾″ and 1″ rings gave the best results; their surface areas in sq. ft. per cu. ft. were 75.8 and 52.2 respectively, and the voids 59.36% and 58.14%. (The granite had 30 sq. ft. and 45.3%.) "The high efficiency of the process at the high rates of application was due, to a considerable extent, to the colloider action of the filters." Using 1″ rings, the pounds of B.O.D. removed per acre-foot of filter was 389 by filter plus 80 by post-settling at the 2 mgd rate, but at the 16 mgd rate was 2480 by the filter plus 2020 by post-settling.

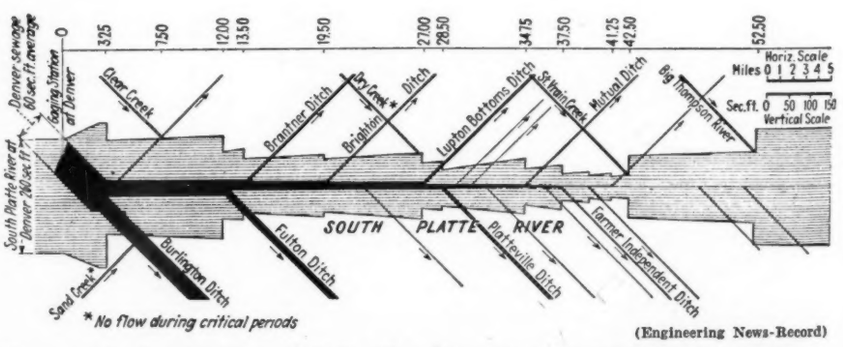
At the 2 mgd rate, using granite, the B.O.D. of the settled influent averaged 186 ppm, that of the effluent 56 ppm, and of the settled effluent 24 ppm; while at the 16 mgd rate the B.O.D. was 226, 128 and 49 ppm respectively. With ¾″ rings, at the 2 mgd rate the B.O.D. was 186, 35 and 12 ppm respectively, and at the 16 mgd rate was 226, 111 and 24 ppm. The B.O.D. of settled effluent from ¾″ rings at 16 mgd was the same as from stone at 2 mgd.

Among other results were: "Nitrification was distinctly better with the small size Raschig rings (¾ to 1 in.) than with the other filtering materials. Considerably larger proportions of the filter effluents were in settleable form at the higher rate (16 mgd) than were obtained with the customary rate now employed for sewage treatment 2 mg). The B.O.D. removal per acre-foot of filter by filtration alone rose from 350-420 lbs. at the 2 mg rate to 2180-2560 lbs. at the 16 mg rate. The B.O.D. removal per acre-foot by filtration and post-settling increased from 45 lbs. to 3950 lbs. with granite, and with Raschig rings it rose from 469 lbs. to 4500 lbs. as the rate increased from 2 to 16 mg.[C42]

Ferric chloride for the new Denver sewage treatment plant will be made at the plant at an estimated cost of $37 a ton or 5.68 cts. per lb. of ferric chloride—less than the cost if purchased, including freight. Four reaction tanks are provided, with false bottoms of concrete blocks and pipes rubber lined or rubber hose, in which tin cans or other scrap iron will be placed, and a 0.34% solution of chlorine introduced under the false bottom will pass up through the iron with a reaction period of 90 minutes; the effluent passing into another tank where additional chlorine may be added if necessary; or copperas and chlorine can be fed into the oxidizing tanks. [E25]

Denver's new treatment plant is required to prevent nuisance and danger of typhoid in Platte river water which is used for irrigation. The city's sewage averages 21% of the total river flow below Denver and 74% of the minimum flow. Just below Denver 130,000 acres are irrigated from the river, 18,000 as truck gardens, receiving 46% of the city's sewage and 90% of the remainder is used for irrigation in the next 40 mi.; much of which, relieved of its pollution, returns to the river.

Among the interesting features of the plant are—shredding of screenings and returning to sewage. Screened sewage is aerated (0.05 cu. ft. of air per gal.) and coagulant added, mixed 15 mm., and settled (2 hr. detention). Then filtered downward through 3″ of magnetite sand (0.5 mm. effective size) at a normal rate of 2.68 gpm per sq. ft.; sand to be cleaned by



(Engineering News-Record)

Diagrammatic Representation of Platte River flow below Denver showing entrance of sewage and tributaries and diversions to irrigation canals

means of solenoid-operated devices. Sludge removed from drying beds by belt conveyors each 200 ft. long onto which sludge will be shoveled by hand. Mechanical equipment, purchased direct from the manufacturers for $114,351, includes: 3 mechanically cleaned bar screens with individual shredders; 2 grit chambers; 4 140′ circular clarifiers; 4 floating covers for 85′ circular digesters; 5 150 gpm centrifugal sludge pumps; 2 travelling belt conveyors; 2 chlorinators, each of 1000 lb. per day capacity.[E25]

Sea dilution of the sewage of 250,000 population of Swansea, England, began in August, with the inauguration of a sea outfall into the Bristol Channel consisting of a pair of 5 ft. cast iron pipes encased in concrete. These lead from four storage tanks, each 1,995 ft. long, 16 ft. 6 in. wide and 10 ft. 6 in. high, tunnelled in solid limestone at a depth reaching 200 ft. below the surface. The trunk sewer leading to these is 7′ 9″ by 5′ 6″ ovoid section, reducing to 5′ 6″ circular; part of the latter being on poor foundation, where cast iron pipe on reinforced concrete piles was used. In addition, the scheme involves 45 miles of new sewers and 6 pumping stations. [D37]

Air conditioning waste water overloaded the sanitary sewers of Lincoln, Neb., last summer, and either relief sewers must be built in the business district or air conditioners must be connected to the storm sewers. The latter is required by an ordinance recently passed. It is estimated that cooling water will reach a total of 17.28 mgd in this district of 22 blocks.[E23]

Centrifuging sludge began in September in Toronto by means of an "American" centrifuge made by Allis-Chalmers Co.; weight 20,000 lb., bowl 42″ diam.; max. separating speed 2,000 rpm, developing a pressure on the cake of 600 lb. per sq. in. This machine designed from 2½ yrs. testing of a full-size one at Collingswood, N. J. It is a continuous batch machine, operating in automatically repetitive cycles. On starting, bucket elevator feeds sludge into the basket through a hopper until predetermined amount has been fed, basket meantime revolving at high speed; then basket is decelerated, high-speed motor de-energized, another motor starts two cutters in basket to cutting the sludge cake and feeding it through a center opening onto a conveyor belt; then process automatically repeats itself. Amount of sludge fed per batch and duration of centrifuging can be adjusted in a few seconds. Undigested, unconditioned sludge is centrifuged, preferably but not necessarily fresh. Advisable to precede it with thickener—increases production capacity. Moisture content of cake, 62 to 65%. "Large-volume production is absolutely essential to make the centrifugal process economically practical." Effluent is returned to crude sewage or thickener tank.[M9]

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c, Indicates construction article; *n*, note or short article; *p*, paper before a society (complete or abstract); *t*, technical article.

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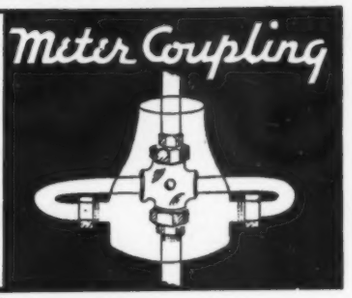

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10. Installing Sewer Outfall on Soft Foundation. By D. L. McLean, pp. 63-64.

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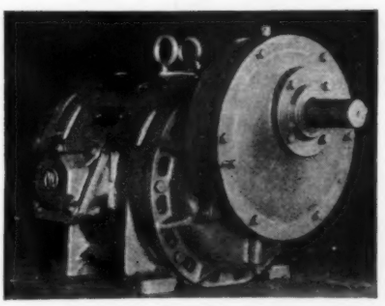

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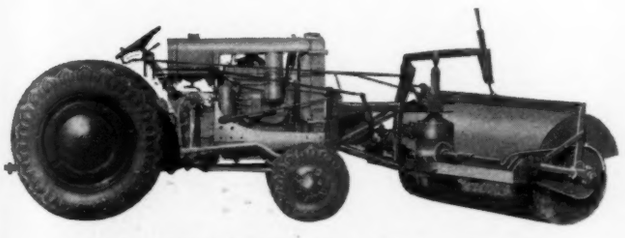
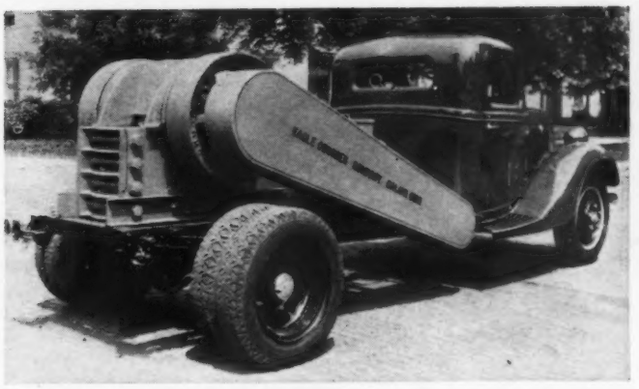
Hough Tractor Sweeper

The Frank G. Hough Co. of Chicago, Ill., are now in production on their new Tu-Way Tractor Sweepers. Original machines of this type have been in use for years for snow sweeping by municipalities, parks, cemeteries, large industrial plants, etc. This new model incorporates many improvements and refinements such as ball and roller bearings, fully enclosed gear boxes and the exclusive two-direction brush which permits sweeping either to the right or to the left.



Hough Tractor Sweeper has many improvements



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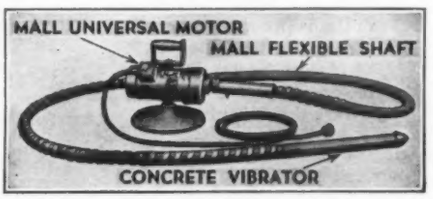

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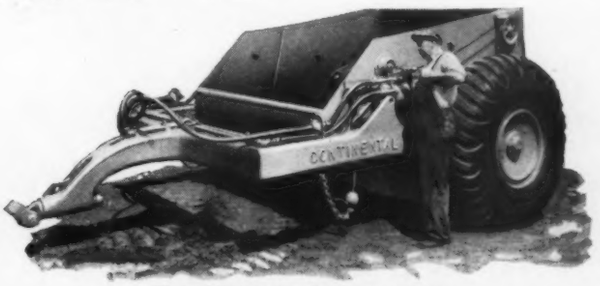

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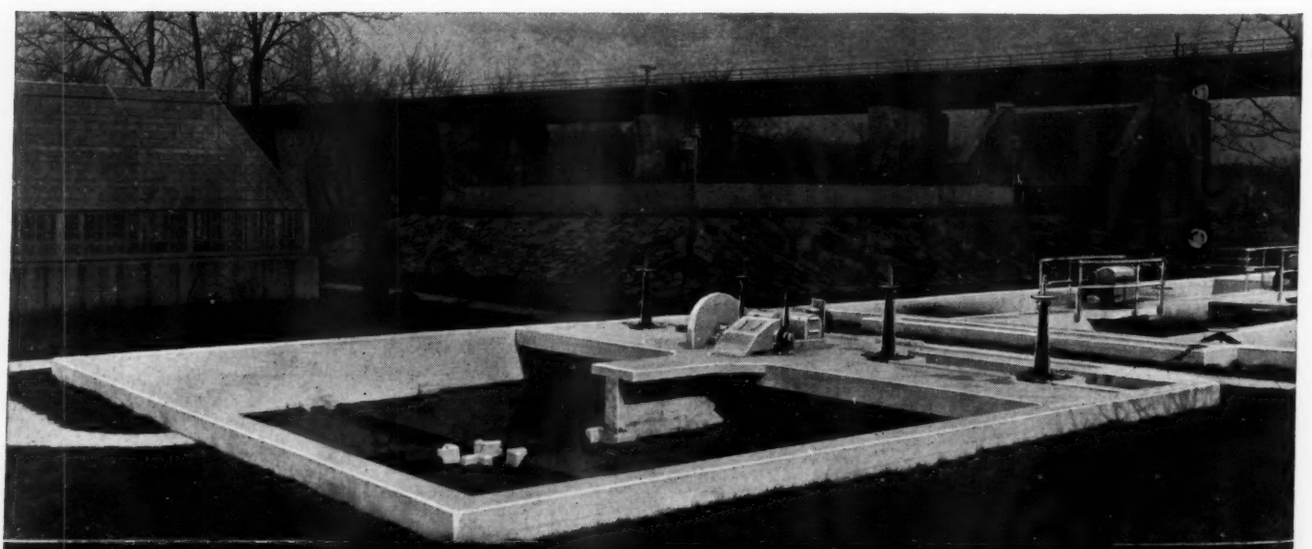

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Don't forget the READERS' SERVICE DEPT.—pages 55-57

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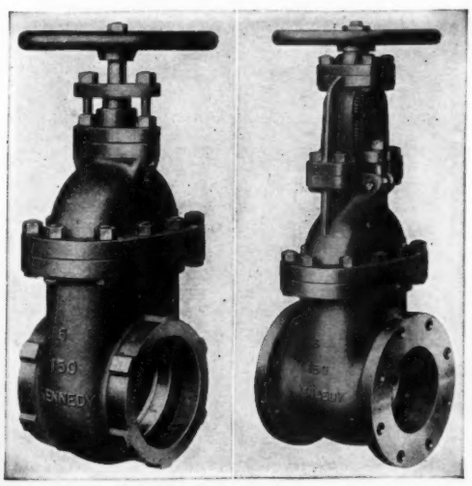
Kennedy Valve Mfg. Co., Elmira, N. Y., announce a new line of standard iron-body, wedge gate valves. The metal used is particularly dense and strong. These are made in all standard sizes from 1½-inch to 60-inch for pressures up to 200 pounds. These new valves have many interesting features. The valves are illustrated herewith; the many details of construction, which should be of interest to waterworks men, are too lengthy for adequate description here. Complete information on these valves will be sent on request to the editor of PUBLIC WORKS or to the manufacturers.



New Kennedy Water Works Valves

An All-Purpose Material Spreader

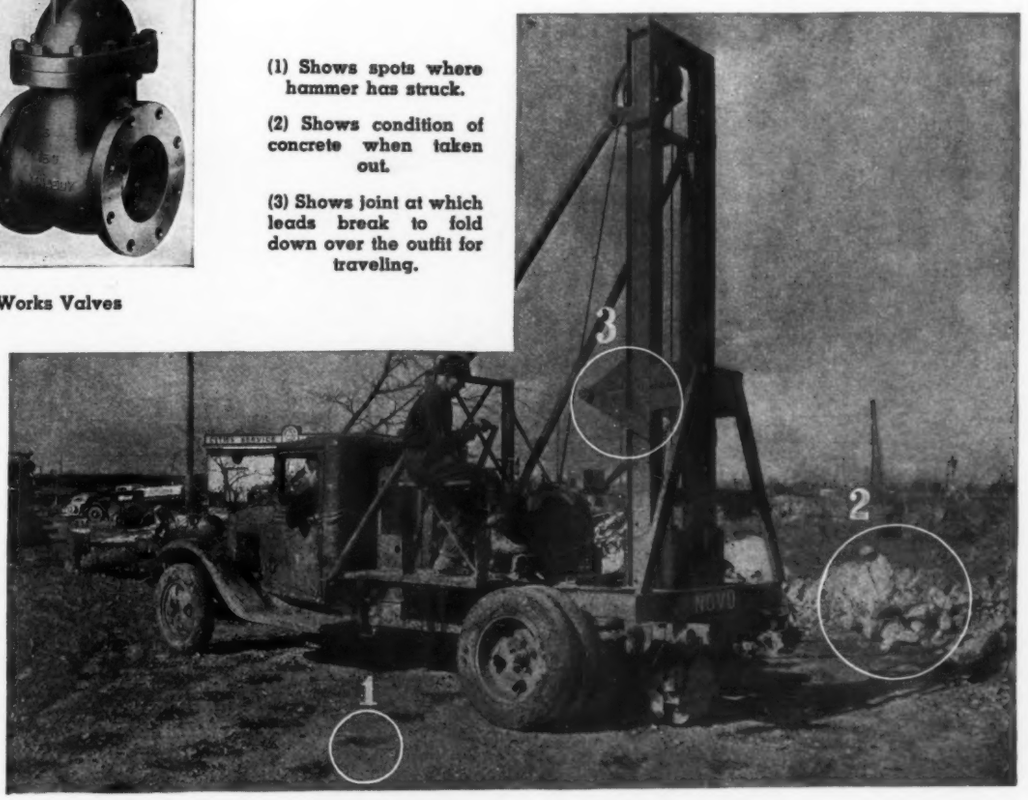
A new material spreader has been announced recently by the All-Purpose Spreader Co., Elyria, Ohio, which is claimed to be applicable to the spreading of dust, screenings, pea gravel, chips, dust laying chemicals on new macadam and black top construction and maintenance; and on spreading cinders, sand, salt, or chemicals for anti-skid work.

The device is attached to the back of a dump truck, materials being dumped through an opening in the end gate into a large hopper. The material is then discharged through a manually controlled measuring gate in the hopper onto a whirling or revolving disc which casts the material onto the ground in a circular or umbrella-shaped shower of material. The power for whirling the disc comes from the traction of the four industrial-type pneumatic balloon tires on which the spreader rests.

Due to the differential action, it is claimed that the spreader is equally efficient in either forward or backward direction. It also maintains the uniform disc speed on curves to permit the same coverage per square yard as on straight-a-ways.

The light weight of the spreader, resting on four balloon tires, reduces ground pressures to a point which permits spreading without disturbing keyed subgrades. The differential action eliminates skidding, binding or sliding of the wheels over the subgrade. A wide range of width of spread is obtained varying from 3 ft. on shoulder work to 30 ft. on anti skid work. Great flexibility is also given on the permissible coverage per square yard which can be varied from 0 to 85 lbs. of material per square yard.

All-Purpose Spreader shown in action above and at rest below



(1) Shows spots where hammer has struck.

(2) Shows condition of concrete when taken out.

(3) Shows joint at which leads break to fold down over the outfit for traveling.

Novo Pavement Breaker at work on highway near Flint, Michigan, breaking 10" concrete which has been reinforced with ¼" and ⅜" steel. Outfit is operating in below-zero weather and the ground is frozen 3' to 4' below the concrete. Contractors are Hamer Brothers of Detroit, Michigan. Outfit is owned and operated by the Finn Equipment Company of Cincinnati, Ohio.

Harry Jordan Becomes Secretary of the American Water Works Association

Harry E. Jordan, for many years chemical engineer of the Indianapolis Water Co., and long active in the affairs of the American Water Works Association, has been appointed secretary of that association, succeeding Beekman C. Little. Mr. Jordan's record includes more than 17 years of association service, including director, president (in 1934-35) and recipient of the John M. Diven award for outstanding service.

Mr. Jordan will assume the duties of the office as of December 1. He will move to the New York area so that the office in New York City will have the benefit of his constant presence and supervision.

It is hard to think of anyone that is better fitted for the work than Mr. Jordan, and his personality and ability should accomplish wonders in Association work.

American Road Builders' Association

The official nominations for officers for 1937-1938 and directors for three years, as submitted by nominating committee, are as follows: For president, Willard T. Chevalier, vice-president, McGraw-Hill Publishing Co., New York, N. Y.; for vice-presidents, Paul B. Reinhold, secretary-treasurer, Reinhold & Co., Inc., Pittsburgh, Pa.; Alex Hancock, Hancock Construction Co., Mobile, Ala.; Lion Gardiner, vice-president, Jaeger Machine Co., Columbus, Ohio; Stanley Abel, Supervisor, Fourth District, Kern County, Taft, Calif.; for treasurer, James H. MacDonald, consulting road and paving expert, New Haven, Conn.

For directors, the following have been nominated: Term ending 1940, Robert B. Brooks, Consulting Engineer, St. Louis, Mo.; Paul L. Griffiths, vice-president, Koppers Products Co., Pittsburgh, Pa.; A. Lee Grover, secretary, New Jersey State Highway Department, Trenton, N. J.; J. D. Manley, Manley Construction Co., Ocala, Fla.; W. A. Olen, president, Four Wheel Drive Auto Co., Clintonville, Wis.; J. E. Pennybacker, managing director, the Asphalt Institute, New York, N. Y.; H. G. Sours, county engineer, Summit County, Akron, Ohio.

Personal News

C. W. Garrison has resigned as account executive for the Burns-Hall Advertising Agency, Milwaukee, to become Advertising and Sales Promotion Manager of the Cleveland Tractor Company, Cleveland, Ohio. Preceding his connection with Burns-Hall, Mr. Garrison was a director and account executive of Freeze-Vogel-Crawford, Milwaukee, in which capacity he served the Allis-Chalmers Mfg. Co., Tractor and Texrope Drive Divisions, in addition to manufacturers of other industrial equipment.

M. B. Tark, engineer of the Link-Belt Co., and well known throughout the sanitary engineering field, has practically recovered from a serious illness and will soon be back in the field. We regret Mr. Tark's illness, congratulate him on his recovery, and welcome him back to his work.

Francis M. Higgins, formerly market research analyst of the Four Wheel Drive Auto Co., Clintonville, Wisc., has been named manager of advertising, succeeding W. M. Hanson, resigned.

Peter M. Lorenz has been appointed manager of the St. Louis district for the Inland Steel Co., Chicago. Frederick A. Ernst is assistant manager. Mr. Lorenz served with the Ordnance Department during the war.

Earl D. Stearns has been appointed sales manager of the Barber-Greene Co., Aurora, Ill.

C. F. Mullins has been appointed by Caterpillar Tractor Co., Peoria, Ill., as sales engineer in the construction and governmental fields. His headquarters will be at San Leandro, Calif.

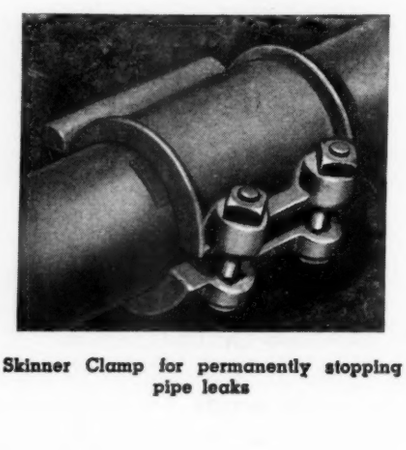
White Truck Record Week:

Truck and fleet bus orders aggregating more than $2,000,000 were received by the White Motor Co., Cleveland, O., in one week recently. October was expected to set a new high record for deliveries, according to Robert F. Black, president.

The Electric Bleaching Gas Co. and its affiliate, Niagara Alkali Co., have moved to the Lincoln Bldg., 60 East 42nd St., N. Y.

Permanently Stopping Pipe Leaks

Easily applied clamps for permanently stopping leaks in pipes, regardless of how large or small, whether high or low pressure, are applied while pipe lines are in service except upon extremely high-pressure lines. Pipe clamps of this type are represented by the radically redesigned pipe clamp illustrated, a product of the M. B. Skinner Co., 3737 W. Sample Street, South Bend, Indiana. To insure absolutely that every clamp is as perfect as humanly possible this company has installed equipment to test every clamp under a pressure of 3,000 lbs. before it leaves the factory.



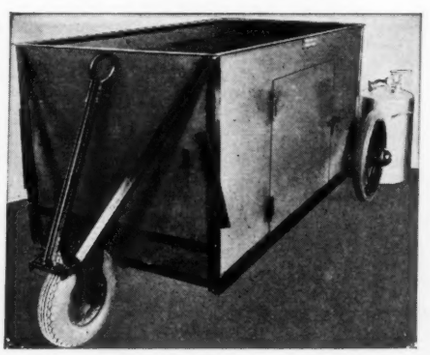
Skinner Clamp for permanently stopping pipe leaks

These clamps are invaluable when leaks show up or when the first frost splits or bursts exposed pipes.

A. C. Brumley has recently joined the Research department of the Activated Alum Corporation of New York, N. Y. He will assist in the development work now being conducted by this company in the interest of better drinking water. Mr. Brumley graduated from Yale University last Spring where he studied chemistry and economics.

Rock Asphalt Heaters for Maintenance

In cold weather it is often advisable to heat natural rock asphalt before laying it; this is especially true of material that has been stockpiled for some time. Heated rock asphalt assumes full compaction much better than cold material and makes a patch that stays in place.

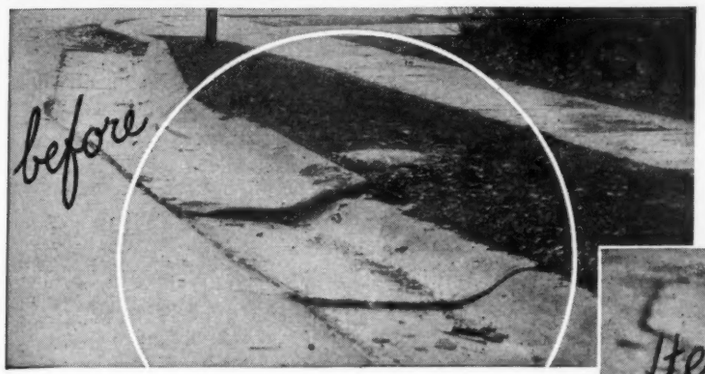


New Road Asphalt Heater

The heater illustrated consists of a heater and a plain steel box mounted on wheels. Near the top of the box is a heavy wire mesh screen on which the material is dumped and under which is a heat deflector. As the rock asphalt becomes warm, it drops through the screen into the lower compartment; a hinged door to this permits shoveling out.

This outfit has many other features of value in street work. A full description can be obtained by writing the White Manufacturing Co., Elkhart, Indiana, or to A. H. Hinkle, director of the Kentucky Rock Asphalt Institute. The heater was devised by cooperation between these two organizations.

MUD-JACK METHOD
for raising concrete curb · gutter · walks · street



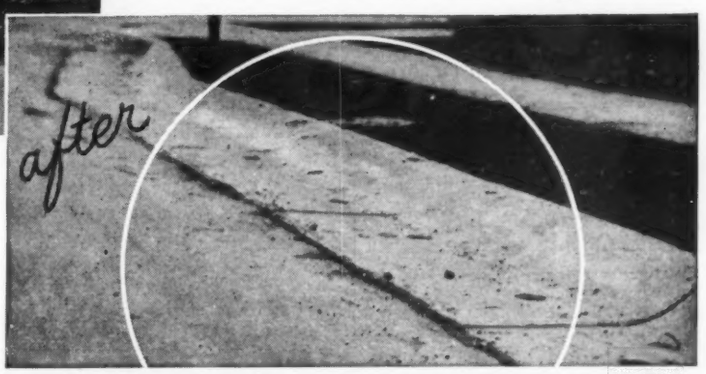
Sunken Curb and Gutter Marked for Reconstruction

but

THE MUD-JACK METHOD *corrected the settlement and saved the reconstruction costs*

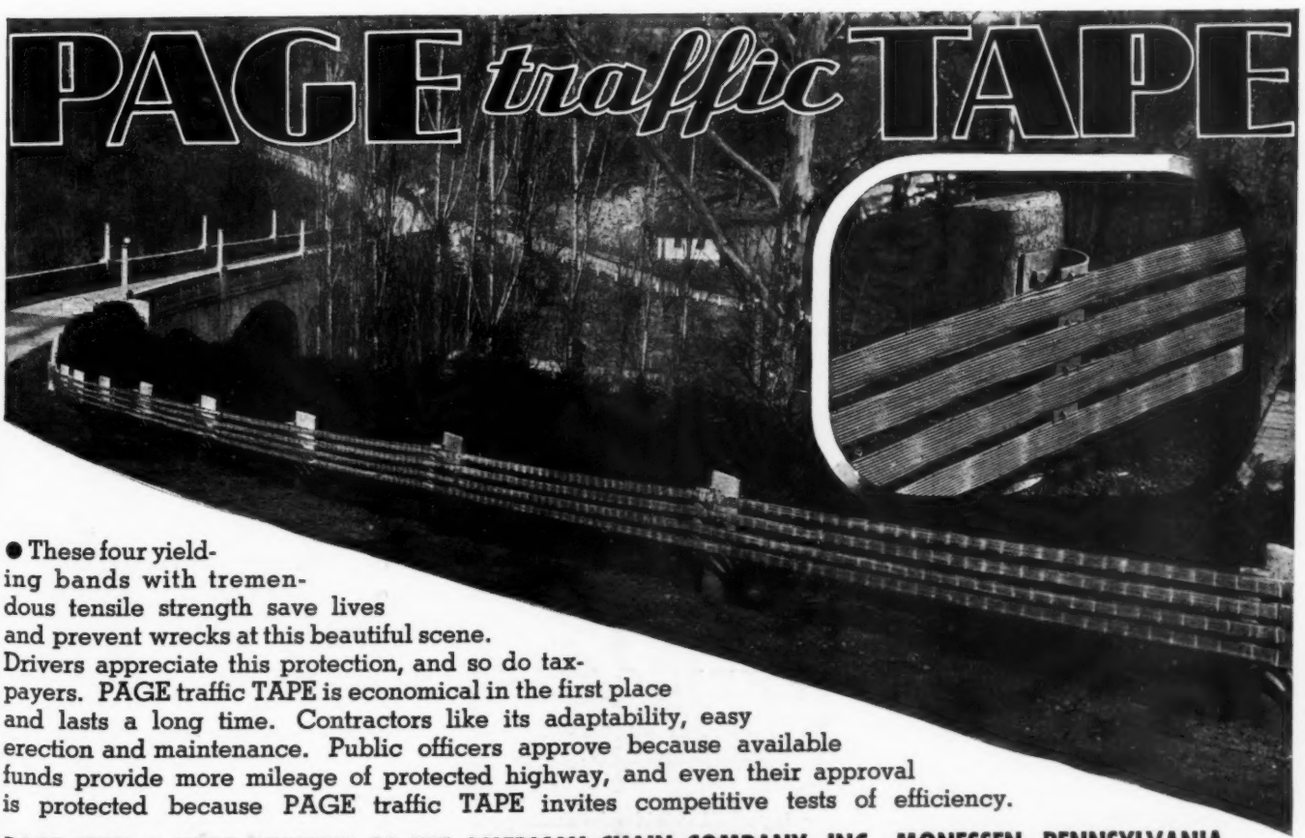
Save CURB — GUTTER
WALKS — STREETS

The Mud-Jack method saves the slab —corrects the subgrade—eliminates pedestrian hazards. Write for data to reduce maintenance expense.



KOEHRING COMPANY
Pavers · Mixers · Shovels · Cranes
Draglines · Dumptors · Mud-Jacks
3026 WEST CONCORDIA AVE. MILWAUKEE, WISCONSIN

PAGE *traffic* TAPE



● These four yielding bands with tremendous tensile strength save lives and prevent wrecks at this beautiful scene. Drivers appreciate this protection, and so do taxpayers. PAGE traffic TAPE is economical in the first place and lasts a long time. Contractors like its adaptability, easy erection and maintenance. Public officers approve because available funds provide more mileage of protected highway, and even their approval is protected because PAGE traffic TAPE invites competitive tests of efficiency.

PAGE STEEL & WIRE DIVISION OF THE AMERICAN CHAIN COMPANY, INC., MONESSEN, PENNSYLVANIA

District Offices: New York, Pittsburgh, Atlanta, Chicago, San Francisco

In Business for Your Safety

When you need special information—consult the *classified* READERS' SERVICE DEPT., pages 55-57

REFLECTIONS IN RETROSPECT

IT SEEMS but a very short while ago since Geo. R. Spalding demonstrated at Hackensack, New Jersey, the effectiveness of powdered activated carbon in the treatment of water for taste and odor removal. Previously, attempts had been made to introduce the product in granular form but indications of high equipment cost and uncertainty of results had made water operators somewhat skeptical of this new medium as a dependable and economical purification tool.

Literally, much water has gone over many dams since that time—six or seven years ago, and the doubts and fears then felt have been entirely dissipated. So great has been the progress in the adoption and use of powdered activated carbon as a positive means to control tastes and odors in drinking water, that in the neighborhood of 1,000 plants—municipally and privately owned—in this Country alone have proven its benefits in this respect and its use is fast spreading throughout the world; a testimonial to the initiative and enterprise of those responsible for the operating of American water plants.

Today, there is such faith and confidence in activated carbon as a means of eliminating tastes and odors, that its use can be safely looked upon as a standard purification practice and no other method of water purification has achieved such a position in so short a time; surely concrete evidence of the merit of the product for such purpose.

In retrospect, one can go back to the questions of doubt that were raised; such as, powdered carbon would not be removed in the sand filters; it might decrease the filter runs, also accelerating mud ball formation. It was further questioned whether powdered carbon would remove tastes and odors of a serious nature, or, if it did, the treatment would be too costly. Wide experience in operating hundreds of water plants had proven to the contrary, and it has been demonstrated conclusively that there is no taste and odor condition which cannot be corrected when an adequate quantity of Aqua Nuchar is used.

Trouble with the control of taste and odor is one of the biggest worries of the water plant officials because such a condition reaches and registers in every home in the community. Naturally, the cost of furnishing a uniformly palatable water at all times must be considered. In the case of unusual taste and odor epidemics, quantities up to 300 lbs. of Aqua Nuchar per million gallons have been used but such conditions rarely occur, and during a period of twelve months the cost per million gallons is negligible. Taking the average case, an official study of over one hundred water plants shows the average quantity reported was approximately 16 lbs. per million gallons; and even if this average was doubled, obviously it would be a very small amount to pay for water that satisfies.

As the use of powdered activated carbon became wider, some further benefits from the treatment developed. For example, the application of the carbon along with the alum in the mixing chamber has resulted in a better floc formation and, in some cases, to such an extent that the amount of coagulant has been reduced. Further, it has been convincingly proven that the sludge in the sedimentation basin is stabilized by inhibiting decomposition, preventing gas formation and the incidental scum. In certain plants where the supply of raw water is badly contaminated, necessitating super-chlorination, it has enabled the operators to get rid of the objectionable chlorine taste by reason of the carbon acting as a dechlorinator, so that these operators can not only supply an absolutely safe water but also a palatable one, thus getting rid of a lot of complaints.

Today, activated carbon is the cheapest form of insurance that a water plant can take out to protect the palatability of its supply under all and any conditions. Necessarily, such conditions vary considerably throughout the Country and where epidemics occur—as they sometimes do—the cost of the carbon may seem high during this temporary situation. It is calculated on the basis of 20 lbs. of carbon per million gallons of water used each day in the year based on a per capita consumption of 100 gallons daily, it would make the cost to each individual within the community only slightly over 3c per year. To those plants that are subject at certain seasons to severe epidemic conditions, we recommend the use of a small quantity of Aqua Nuchar every day, depending upon individual circumstances, as being more economical because when the carbon is well distributed throughout the plant as the severe tastes and odors arise, the condition will not reach a point where excessive dosages are needed. Such a procedure will provide maximum insurance of palatable water without increasing the total premium paid.

SALES MANAGER

INDUSTRIAL CHEMICAL SALES CO., Inc.

230 PARK AVENUE
NEW YORK

205 WEST WACKER DRIVE
CHICAGO, ILL.

418 SCHOFIELD BLDG.
CLEVELAND, OHIO

Following the trend of the times towards the merging of all subsidiaries under parent management; about December 1st, we will cease to be a separate corporate entity and will function as the Chemical Sales Division of the West Virginia Pulp & Paper Company.

Readers' Service Department

These booklets are FREE to readers of PUBLIC WORKS.

CONTINUED FROM PAGE 56

sewer construction where replacement, repairs or reconstruction would be costly, cast iron pipe is most economical. For details, specifications, etc., write Thomas F. Wolfe, Cast Iron Pipe Research Ass'n. 1013 Peoples Gas Bldg., Chicago, Ill.

Couplings for Pipe

386. This sixteen-page booklet is a reprint of a magazine article by a consulting engineer. It describes in detail the installation of a 42" water line; contains specific information regarding pipe joints, field organization, laying pipe, tests, back-filling, etc. Sent free by S. R. Dresser Manufacturing Company, Bradford, Pa.

Fire Hydrants

388. Two new bulletins on M-H fire hydrants and fully bronze mounted gate valves are now ready. Contain full specifications and instructions for ordering, installing, repairing, lengthening and using. Write M. & H. Valve & Fitting Co., Anniston, Ala.

Gate Valves

390. 28 page catalog contains illustrations and complete specifications of M-H standard and extra heavy iron body gate valves, horizontal swing check valves, flanged fittings and flanges, etc. Sent promptly on request by M. & H. Valve & Fittings Co., Anniston, Ala.

Glass Covers

393. Full details regarding the use of Lord & Burnham Glass-Overs at Middletown, N. Y.; Marion, Ohio; Cleveland, Ohio; Freeport, N. Y.; Kitchener, Canada; West Chester, Pa., and other places are given in bulletins 22 to 33. Sent promptly on request to Lord & Burnham Co., Irvington, N. Y.

Laboratory Equipment

400. The Phipps & Bird Stirrer, the solution feeder, a forthcoming stirrer using air for mixing, and all sorts of laboratory equipment for water and sewage plants. Bulletins and folders covering these pieces of equipment are complete and interesting. Phipps & Bird, Inc., 915 East Cary St., Richmond, Va.

Manhole Covers and Inlets

403. Nuisance from loose, noisy manhole covers is eliminated by the use of Westeel rubber cushioned manhole covers and gratings. Six special advantages are explained in a new illustrated bulletin just issued by the West Steel Casting Co., 805 East 70th St., Cleveland, Ohio.

404. Street, sewer and water castings made of wear-resisting chilled iron in various styles, sizes and weights. Manhole covers, water meter covers, adjustable curb inlets, gutter, crossing plates, valve and lamphole covers, ventilators, etc. Described in catalog issued by South Bend Foundry Co., South Bend, Ind.

Pipe, Cast Iron

406. Data on cast iron pipe for water works systems, in sizes from 1¼ to 84 inches, including information on useful life, flow data, dimensions, etc., Thos. F. Wolfe, Cast Iron Pipe Research Ass'n, 1013 Peoples Gas Bldg., Chicago, Ill.

Pipe, 2-inch Cast Iron

407. The new McWane 2" cast iron pipe in 18-foot lengths has innumerable uses in water and sewage work. Send for the new McWane bulletin describing this pipe, the various joints used, and other details about it. McWane Cast Iron Pipe Co., Birmingham, Ala.

Pipe, Concrete

408. Concrete Pipe Sewers, a 28-page booklet, contains much valuable information and numerous illustrations on concrete pipe. Issued by American Concrete Pipe Association, 33 West Grand Ave., Chicago.

Pipe Forms

409. Making concrete pipe on the job to give employment at home is the subject of a new booklet just issued by Quinn Wire and Iron Works, 1621 Twelfth St., Boone, Ia., manufacturers of "Heavy Duty" Pipe Forms. Sent promptly on request.

Pipe Joints

410. New folder describes in detail a new type of pipe joint—the Dresser Compression Coupling, Style 65, which is compact and self contained, makes a permanently tight joint under all conditions and is installed on plain end pipe in a few seconds with only one tool, a wrench. Get your copy today. S. R. Dresser Mfg. Co., Bradford, Pa.

Pipe Joint Compound

411. A new bulletin has recently been issued giving full details concerning Tegul Mineralead, a quick-sealing, trouble-free compound for bell and spigot joints which permits immediate closing of the trenches. Write The Atlas Mineral Products Co. of Pa., Mertztown, Pa.

Taste and Odor Control

412. How, when and where activated carbon can and should be used to remove all kinds of tastes and odors from water supplies is told in a new booklet just issued by Industrial Chemical Sales Co., Inc., 230 Park Ave., New York, N. Y. 32 pages, table, illustrations and usable data.

Pumps and Well Water Systems

413. Installation views and sectional scenes on Layne Vertical Centrifugal and Vertical Turbine Pumps, fully illustrated and including useful engineering data section. Layne Shutter Screens for Gravel Wall Wells. Write for these three descriptive booklets. Layne & Bowler, Inc., Dept. W, General Office Memphis, Tenn.

Protective Pipe Coating

415. Coal-tar Pitch Enamels for exterior and interior linings for steel water lines; highly resistant to water absorption, soil acids and alkalis. Technical specifications for materials and their application will be sent on request. The Barrett Company, 40 Rector St., New York, N. Y.

Pumping Engines

417. "When Power Is Down," gives recommendations of models for standby services for all power requirements. Sterling Engine Company, Buffalo, N. Y.

Rubber Lined Pipes and Pumps

418. New, 68-page catalog describes Ace rubber lined pipe and fittings, hard or soft rubber lined centrifugal pumps and Ace hard rubber double acting pumps, for chemicals used in treating sewage and water and for acids and other corrosive liquids. Contains illustrations and specifications. Issued by American Hard Rubber Co., 11 Mercer St., New York, N. Y.

Run-off and Stream-Flow

420. Excellent booklet describes and illustrates the latest types of instruments for measuring run-off, both from small areas for storm sewer design, and from large areas for determining water shed yield. Sent promptly by Julien P. Friez & Sons, Baltimore, Md.

Screens, Sewage

421. The simple, automatic Loughlin, self-cleaning travelling screen is fully described in an interesting bulletin issued by Filtration Equipment Co., 10 East 40th St., New York, N. Y.

423. Be assured of uninterrupted, constant automatic removal of screenings. Folder 1587 tells how. Gives some of the outstanding advantages of the "Straight-line Bar Screen" (Vertical and Inclined types). Link-Belt Co., 307 N. Michigan Avenue, Chicago, Ill.

Setting and Testing Equipment for Water Meters

424. All about setting and testing equipment for Water Meters—a beautifully printed and illustrated 40 page booklet giving full details concerning Ford setting and testing apparatus for all climates. Ford Meter Box Co., Wabash, Ind.

Rainfall Measurement

429. The measurement of precipitation, exposure of gauges, description of apparatus for measuring rainfall, both rates and amounts. Bulletin RG and Instruction Booklet. Julien P. Friez & Sons. Baltimore, Md.

Screens

430. Water Screen Book No. 1252, describes traveling water intake screens and gives complete technical information about them. Link-Belt Co., 307 No. Michigan Ave., Chicago, Ill.

Sludge Bed Glass Covers

432. Sludge Bed Glass Covers—"Super-Frame." Hitchings & Co., Elizabeth, N. J. Offer A. I. A. File 101SB, describing glass covers for sludge and sprinkler beds; details, specifications and cost data.

Sludge Incineration

438. A multiple hearth furnace which meets the most exacting municipal sanitary requirements for the incineration of sewage sludge—produces a fine ash or partially dry sludge for fertilizer—is described and illustrated with drawings and photographs in bulletins issued by Nichols Engineering and Research Corp., 40 Wall St., New York, N. Y. Operation as well as installation data is given.

440. Disposal of Municipal Refuse: Planning a disposal system; specifications. The production of refuse, weights, volume, characteristics. Fuel requirements for incineration. Suggestions for plant inspection, 45 pp., ill. Also detailed outline of factors involved in preparation of plans and specifications. Morse-Boulger Destructor Co., 202P East 44th St., N. Y.

Sludge Removal Equipment

442. If you are interested in economical sludge removal, write for the latest bulletin describing and illustrating Louden Monorail equipment which is adapted to open or closed beds. Full details sent promptly by the Louden Machinery Co., 400 West Ave., Fairfield, Iowa.

Swimming Pool Equipment

444. Filters, chlorination, underwater lights and other supplies for swimming pools are very thoroughly described in literature and folders. Plans and layouts. Everson Filter Co., 625 W. Lake St., Chicago, Ill.

445. Data and complete information on swimming pool filters and recirculation plants; also on water filters and filtration equipment. For data, prices, plans, etc., write Roberts Filter Mfg. Co., 640 Columbia Ave., Darby, Pa.

Treatment

448. New 31-page catalog covers complete conveying, screening and reduction machinery for water purification and sewage treatment; describes and illustrates the design features of Jeffrey self-cleaning bar screen, combined screen and grinder, sewage screenings grinder, grit washer, conveyor type and positive discharge sludge collectors and green garbage grinder—includes installation views. Catalog 615, Jeffrey Manufacturing Co., Columbus, Ohio.

450. Standard Sewage Siphons for small disposal plants and PFT Rotary Distributors are new catalogs recently issued by Pacific Flush Tank Co., 4241 Ravenswood Ave., Chicago, Ill. The latter catalog contains typical plans and many illustrations of actual installations.

452. Eliminate sludge bed troubles, forget about weather conditions, odor nuisance, hail insurance and the like. Full details as to how Oliver United Vacuum Filters overcome these problems will be sent to all interested by Oliver United Filters, Inc., 33 West 42nd St., New York, N. Y.

453. How to avoid sludge and scum troubles in settling tanks explained in detail in Book No. 1542—has excellent drawings and photographs, also specifications. Most important are the carefully prepared capacity tables. Link-Belt Co., 307 N. Michigan Ave., Chicago, Illinois.

454. Full information regarding their newest equipment for sewage treatment and water purification will be sent on request by The Dorr Co., 247 Park Ave., New York, N. Y.

For the Engineer's Library

The editors will be glad to assist readers in getting copies of publications mentioned here.

Rural Zoning Ordinances:

This 40-page booklet, published by the Agricultural Extension Service of the University of Wisconsin, Madison, Wisc., states the necessities and advantages of rural zoning, gives the legal basis for such zoning, and presents a model county zoning ordinance. This is a new subject and an important and promising one. We believe that this booklet will be sent free on request. It was prepared by W. A. Rowlands and F. B. Trenk, with assistance by Prof. G. S. Wehrwein.

Frink Sno-Plows:

A helpful feature of this Frink Catalog is the data on selecting the proper snow plow for your truck. The Frink leveling wing and attachments are described thoroughly also, as are the one-way "Speed Sno-Plows" for trucks of 1½ to 8 tons capacity. These, by the way, are interchangeable with the standard Frink plows, using the same truck attachments. Copy on request. Carl H. Frink, Clayton, N. Y.

Steel Flanges:

Kropp Forge Co., Chicago, Ill., has issued a 24-page list of stock flanges, which gives dimensions, weights and prices on all standard flanges from ¾" to 24". Engineering data, drilling, threadings, etc., for boiler, tank and nearly all other flanges. Sent on request. Ask for Bulletin 125.

Snow Plows:

A very fine 60-page catalog covering highway snow plows of many types. A feature that should appeal to engineers is the descriptions of the various plow attachments available, such as snow shields, wings, landsides, etc. Another valuable feature is the nationwide data on snow removal and ice treatment, and on snow drift control that has been collected by the Bureau of Public Roads and is published herein. Copy sent on request to J. W. Kitts, Good Roads Machinery Corp., Kennett Sq., Pa.

Heavy Duty Trailers:

Rogers Bros. Corp., Albion, Pa., manufacture a complete line of heavy duty pneumatic tired trailers for handling power shovels, concrete mixers, etc. The trailers are described fully in Catalog 366, which will be sent on request.

Power Control Unit:

Power Control Unit, used on all Le Tourneau equipment. 12 pp., illustrated. R. G. Le Tourneau, Inc., Peoria, Ill.

Unitair Compressors:

The Unitair is a two-stage, completely air cooled V-type, single acting stationary compressor, which can be installed in a short time, available in four sizes to 400 C.F.M. and for any kind of drive. Ask for Bulletin 88-0. Sullivan Machinery Company, Dept. 21, Michigan City, Indiana.

Mixers and Screeds:

The Ransome Concrete Machinery Co., Dunellen, N. J., have just issued two new bulletins. One covers the new Ransome mechanical strike-off, which is said to make possible decided savings in strike-off work on concrete paving jobs. The other provides complete data and specifications on the newest models of the 7-S and 10-S Model T Ransome concrete mixers.

Protecting Underground Lines:

The Thermoile underground conduit gives permanent protection and support for all kinds of underground lines. Ask for Bulletin 351, H. W. Porter & Co., 825 Frelinghuysen Ave., Newark, N. J.

FWD Highway Trucks:

A 16-page illustrated booklet just published by the Four Wheel Drive Auto Company, Clintonville, Wisconsin, and Kitchener, Ontario, Canada. Action "shots" and descriptive detail show the capacity of the FWD truck for snow removal, road building, road maintenance and general hauling work.

Koppers Co. Changes

The name of Koppers Gas and Coke Company, Pittsburgh, Pa., has been changed to Koppers Company, the company has announced. Three subsidiary companies have been or will be dissolved and will become divisions of the parent company. They are: The Koppers Construction Company, which becomes the Engineering and Construction Division; Koppers Products Company, which becomes the Tar and Chemical Division, and The Bartlett Hayward Company, which becomes the Bartlett Hayward Division. The Western Gas Division of The Koppers Construction Company becomes a division of Koppers Company as does the American Hammered Piston Ring Division of The Bartlett Hayward Company. The Maryland Drydock Company, The White Tar Company of New Jersey, Inc., and The Wood Preserving Corporation remain as subsidiaries of Koppers Company.

Officers of the former subsidiaries will become officers of the Koppers Co., parent company, which will change its name to Koppers United Co.

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